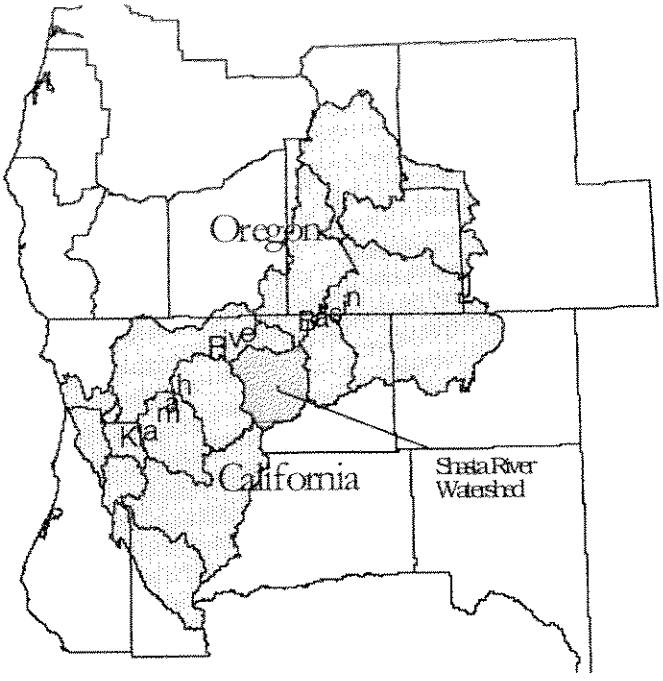
Final Report

Shasta River CRMP Coordinator, 2000



Great Northern Corp.
PO Box 20
Weed, Ca 96094

June, 2001

Cooperative Agreement 14-48-11333-00-G012
Project Number 2000-PC-10

Abstract: Summary of efforts and accomplishments of person employed in the part time staff position for Coordinated Resources Management and Planning (CRMP) group working on salmonid and water quality issues in the Shasta Valley in Northern California during 2000.

2000 included community outreach, ongoing meetings with landowners, agencies and political figures, preparation of materials for inclusion in the Klamath Resource Information System (KRIS) program, fish screen fabrication, Internet access to real time flow data, and the preparation and oversight of restoration projects.

Introduction:

The Shasta River Coordinated Resources Management and Planning group (CRMP) was started in mid-1991, through the combined efforts of several members of the ranching community, the Siskiyou RCD, and the Natural Resources Conservation Service (then Soil Conservation Service). At that time there was no similar organization in Siskiyou County, and the prospect of developing a good working relationship amongst the various landowners and agencies seemed unlikely.

Given the magnitude of the task undertaken—to restore the productivity of the Shasta, while maintaining a healthy local agricultural economy—it was clear that efforts beyond what a volunteer group was capable of were required. Recognizing this, the Klamath River Basin Fisheries Task Force provided funding in FY 1992 for a part time Projects Coordinator to assist the CRMP in progressing from discussion, self-education and planning to project implementation, grant funding and community outreach.

That funding has been renewed at varying levels in FY 1993, 1995, 1996, 1997, 1998, 1999, 2000, and 2001. Partial supplemental funding was made available through a grant from the Calif. DFG for 2000 and 2001.

Description of Study Area:

The Shasta River and its major tributaries are part of the Klamath Basin (see map on cover), and total hundreds of miles in length, draining an area of approximately 800 square miles.

They flow almost entirely through relatively small parcels of private ranch land. To be effective, any activity aimed at improving water quality for fish or human needs must be done with the active help and participation of a large number of individual owners whose needs, desires and financial conditions vary greatly.

Each of these ranchers has long-standing cultural practices, many of which depend on the river, including irrigation of pasture and hay fields, grazing of riparian areas, and watering of livestock. All of these activities can have a substantial impact on water quantity and quality.

Historically the Shasta River was an important spawning and rearing area for chinook and coho salmon, and steelhead. Records of fall chinook spawners kept since the 1930's show a long decline, from over 80,000 in 1931 to as few as 530 in 1992. Since 1992, numbers have climbed to as high as 13,000. steelhead and coho are likewise no longer present in significant numbers, although actual counts are not available.

Over the last ten years there has been an extensive program of water testing in the Shasta. Results indicate significant problems for cold water fish resulting from high water temperatures and low levels of dissolved oxygen. Additional fieldwork indicates severe problems of fine sedimentation. Other observed but less well documented problems include: blockage of coarse sediment by dams, groundwater withdrawals capable of affecting surface flows, high nutrient levels and consequent turbidity caused by free-floating algae.

The Shasta CRMP coordinator is charged with developing responses to these problems, helping landowners to embrace solutions, securing funding to pay for part or all of the changes proposed, and supervising project implementation.

Methods and Materials:

The Shasta CRMP serves generally as a broad oversight body, with the details of implementation of its goals left to the project coordinator. The coordinator works with individual CRMP members, agencies, and other groups and individuals to develop and implement specific actions that will further the CRMP's goals. In addition, the CRMP Coordinator must be available to respond to requests for assistance from the USFWS, TWG and Task Force, along with state agencies (including DFG and DWR), schools, and other restoration workers.

Information transfer and reporting is frequently accomplished verbally at CRMP meetings or to individuals, in written form in newsletters and agendas, electronically via email, and photographically. Most residents of the Shasta Valley do not make routine use of computers, so mailings and verbal reporting is the most effective way to communicate with them. Agencies and persons engaged in restoration planning generally all have ready access to computers and the Internet, making electronic data and document transfer their preferred method.

Project documentation has been done using photographs and slides, some of which have also been scanned for use electronically on the Internet or in the KRIS.

Post project monitoring and documentation, and responding to needs and opportunities as they arise can require almost anything by way of methods and materials. An engineering autolevel, steel T posts, hacksaw and post driver are used in setting up stream cross section profile locations; Arcview software, plotter and laptop computer were needed to prepare the presentations, temperature measuring devices were placed in streams then downloaded for future use, dissolved oxygen meters were utilized in water quality monitoring, etc.

Results and discussion of accomplishments:

Successfully meeting the overarching goal of this grant--assisting the Shasta CRMP to continue to make substantial steps towards restoring the Shasta River for salmonids--required a variety of approaches. General activities included:

Coordination of fieldwork, both paid and volunteer
Meeting with interested parties, both individually and in groups,
Assisting with planning both within the Shasta Watershed and elsewhere in the Klamath Basin,

Meeting with Task Force and its technical work group,
Responding to problems and opportunities as they arose

This grant included a number of defined tasks to be completed, and specific work products, each of which will be described separately below, followed by a description of some of the more important unexpected opportunities that arose and were acted upon:

Task 1—Evaluate changes over time in instream water temperatures to use in prioritizing CRMP projects.

CRMP Coordinator assembled all available temperature data (Provided to USFWS on disk. Search for data spanned 1900 through the present. Actual range of data spanned 1950 through the present, although everything prior to 1965 was only available in the form of individual grab samples. All data that was not available in electronic form was entered into spreadsheets. In addition, all recent (1994-mid-2000) data was assembled into annual data-sets for each location where data had been collected, checked for validity, outliers removed, and the entire set prepared for inclusion into KRIS (see attachment 1).

Task 2—Make complete historical record accessible via KRIS.

While the temperature data was assembled and cleaned up so that it could be included into KRIS, the data search, data entry and clean-up extended beyond the date for submittal to the soon-to-be-released version of KRIS. USFWS will be able to include it into the next published version. Maps were prepared showing locations of current and historic temperature collection locations to be used with numeric data.

Task 3—Provide information to landowners regarding river conditions past and present.

Coordinator prepared a preliminary report for CRMP on the trends apparent in key sections of the temperature data, along with comparisons to flows and fall chinook spawner numbers. Presentation was made of dissolved oxygen data that was collected through the summer of 2000 at a CRMP meeting in the fall of 2000, along with comparisons to available historic data. Data was discussed in informal meetings with landowners periodically through the year. CRMP also maintained its telephone accessible monitoring station to provide real time access to flow and temperature data in the Shasta. Other information was presented in an ongoing and informal manner.

Task 4—Develop restoration projects for the Shasta River.

Approximately 24 funding proposals were prepared for a variety of projects and submitted to the DFG, TF and ERO. These included funding requests for additional outreach, coarse and fine sediment studies, flow studies, fencing, etc. Funding opportunities used as springboard to re-energize urban residents in Yreka area in Yreka Creek Watershed. Prepared two funding requests focused on Yreka Creek; Initiated contacts with city of Montague regarding wastewater enrichment of Oregon Slough and possible solutions. Postponed preparing urban impacts section to Shasta Plan pending completion of major improvements underway by cities of Weed, Yreka and Montague.

Task 5—Expand and improve Shasta Watershed Restoration Plan

New material was prepared for inclusion in the next re-write of the watershed plan on water use in the Shasta Valley. That section included discussion of irrigation methods, value of water, flow gaging locations and histories, map of diversion points, and an overview of water law and specific details of the Shasta River Adjudication.

Additional material was prepared examining changes in temperature over time in the Shasta Valley. Funds were secured from the Task Force to be used for re-writing the plan in 2001where the above information will be incorporated.

A GIS map layer was prepared outlining all of the 13,000 assessors parcels in the Shasta Valley outside of city limits, along with landowners names and addresses, and key parcel information (see attachment 2).

Task 6—Provide a link between the Shasta CRMP, KRBFTF, and other restoration workers.

CRMP personnel provided tours of the Shasta Valley to persons interested in fisheries restoration (see attachment 3, TWG tour stops), provided written advice to the Scott Watershed group as it went through re-formation, reported to the Task Force on work in progress, and met regularly with the TWG. In addition, the Shasta CRMP Coordinator attended the Salmonid Restoration Federation conference and networked with other restoration workers throughout the state.

In addition, the Shasta CRMP Coordinator spent considerable time working on a variety of issues with the Siskiyou County Natural Resources Planner helping him to better understand the recent historical context of events throughout the Klamath Basin, and also to brainstorm on possible successful approaches to the many water related problems faced by residents of the county.

We were also able to act as hosts to a grad. student class on Natural Resources Issues from Southern Oregon University, taking them to private ranch lands in the Shasta Valley, looking at typical projects, and discussing the competing needs for land and water with landowners.

We also provided the local point of contact and acted as tour guide for the tribal Salmon Camp students from the Hoopa, Yurok and Karuk tribes.

We also volunteered to provide a tour for persons attending the Fall Task Force meeting, where we were able to visit the Fiock Ranch, look at the dam removal project, exclusion fencing, tree planting, spawning salmon (first time on this site in the Fiocks' memory), and talk about challenges throughout the Shasta Valley.

Task 9—Complete one biannual Report and one final Report to the Yreka FWO and 18 copies to provide to the TF members.

Biannual report was submitted in mid-year. This report constitutes the Final Report.

Specific Work Products:

1. Assemble and enter all water temp data into electronic spreadsheet—done and delivered to the USFWS. See tasks 1 and 2. Data sought from 1900 through the present. Data found from 1950 through the present—see attachment 1.

2. Analyze temperature data sets for evidence of changes over time—Report produced and separately submitted—contact USFWS office in Yreka for copies.

3. GIS map of historic temperature sampling locations—completed and attached-- see attachment 2.

4. Continue operation of real time temperature monitoring station—operated through the entire year. Collected data on water temperature, conductivity, flow, and temperature. Gathered air temp., and solar intensity also.

5. Quarterly newsletters and expand mailing list—produced only three newsletters; added all members of all 4 irrigation districts (Grenada, Big Springs, Shasta Water Assoc., and Montague Irrigation Dist.) to our mailing list, along with several individuals who were interested.

6. Re-contact landowners--Contacted landowners throughout the Shasta Valley. Contacts resulted in several livestock exclusion projects, particularly on the Little Shasta River. Contacts also enabled us to help DWR to establish water quality sampling sites throughout the Shasta Valley to collect data to be used to help landowners formulate effective measures to improve water quality.

7. Funding requests—produced over 24 funding requests for a variety of restoration oriented tasks, including coarse and fine sediment budgeting.

8. Riparian lands--made informal inquiries regarding cost of identifying riparian parcels, but was unable to allocate time to fully developing a formal estimate of cost. Did complete preparation of parcel ownership map base which would serve as foundation for this task—see attachment 2.

9. Expand active area of CRMP to include urban areas—re-invigorated Yreka Greenway Committee; successfully encouraged them to take on interest in entire Yreka Watershed; worked with Yreka City Manager to re-involve Yreka, met with consultants working on revising Yreka General Plan to make suggestions for including provisions for future Yreka Creek oriented expansion and improvements. Wrote several grants targeting Yreka for focused assistance on fisheries and water issues. Met with city engineer to introduce him to fisheries issues, and pave the way for future collaboration.

   Worked indirectly with City of Montague to try to resolve problem of periodic overloading of sewage treatment facility, and subsequent release of secondarily treated sewage into the Shasta. Helped prepare plans for expanded area for land disposal of liquid during the summer; Worked through Great Northern Corp to secure for Montague a grant to investigate and begin repairs needed to eliminate infiltration into sewage system.

   Helped DWR begin water quality study as way to gather data on Shasta River above Dwinnell as preamble to working with Weed on water quality issues once they are defined. Met with interested landowners in upper Shasta to begin building group of people interested in making water quality improvements.

10. Water usage document—Prepared and submitted water usage and irrigation report separately to USFWS—contact USFWS office in Yreka for copies.

11. Environmental Baseline Matrix preparation—This effort is still in progress, but nearly complete. Volunteer committee formed to work on it consisting of DFG and USFWS biologists with

working familiarity of the watershed, along with Mike Deas, Jim DePree, and CRMP Coordinator. Assistance provided by HSU. Work demands, particularly on the committee chairman, have kept us from completion of this task. Anticipate one to two additional meetings required, to be followed by final write-up.

12 GIS map of assessor's parcels—complete for all parcels outside of the city limits of Weed, Montague and Yreka. Parcels linked to ownership data—see attachment 2.

13. Meet with TF and TWG—met several times with these groups; prepared written materials to assist them in their understanding of the basin—see attachments 3a and b.

Highlights of the Year:

Shasta CRMP coordinator partnered with an exceptional DFG biologist to finish design and fabrication of two fish screens for use in sites where existing available designs would not work. These two screens on the Lemos and Fiock ranches were completed in time for the start of irrigation in April. The Fiock screen in particular was significant in that it is the culmination of a multi-year effort to permanently remove an irrigation diversion dam that has been seasonally used since 1889, and had contributed to water quality and fish problems ever since.

We continued to refine and test a third innovative fish screen design for a baffled tube screen which has been performing reliably for several seasons. We plan to eventually publish the design details to allow other restoration workers to copy it.

We were able to secure the donation of a dissolved oxygen meter through the county Fish and Game Commission, and put together a major volunteer effort to collect pre-dawn dissolved oxygen data from 4 sites in the Shasta twice per week from May through October, greatly adding to our knowledge base of the fluctuations occurring in water quality, and moving us closer towards developing approaches to meeting TMDL schedules to be determined by 2005—see attachment 4.

A major step forward was the selection of a restoration project on the Shasta River for inclusion in the annual Siskiyou County Cattlemen's tour, where we were able to present photos and discussion on efforts made, changes over time, and possible costs and benefits to the landowner.

Finally, we were able to work with DWR to initiate an intensive two year water quality monitoring program throughout the Shasta Valley focusing on bracketing source areas, and ultimately developing recommendations and suggestions on where and how to address sources of water quality problems.

Volunteer Contributions:

A water quality data collection effort was the main volunteer project for this year, involving hand collection of pre-dawn dissolved oxygen data the length of the agricultural portions of the Shasta Valley from May until October. Other volunteer efforts involved the collection of temperature data, stream cross section data, the preparation and growing of rooted tree cuttings for later planting, general basin wide planning, project oversight and program leadership. Estimated value of volunteer donations approximately $16,000.

Summary and Conclusions:

As is occurring in many other watersheds throughout the state, restoration progress continues to be made. The Shasta continues to be an important producer of salmon, as evidenced by the spawner return of fall chinook of over 11,000 salmon in 2000. The need for substantial improvement continues, particularly in the form of provision for assured instream flows and temperatures, especially in low-water years. The slow workings of the ESA for coho, and the Clean Water Act for TMDLs gives the appearance to many of limitless time, but at the pace we are moving, we will not be where we need to be before each of those legislative initiatives have a substantial impact. Lack of funding for outreach and project development continues to restrict the rate of improvement to be found in the Shasta.

Funding by the Klamath River Basin Fishery Task Force continues to by the most long-standing and reliable assurance of continued restoration progress; competing demands for Task Force funds throughout the Klamath Basin severely limits that group's ability to fully fund outreach efforts anywhere in the Klamath Basin, but without their vision and ongoing support little would have been accomplished to date. Supplemental funding is now becoming available from other sources, raising the hope of improving the rate of change.

Summary of Expenditures, CRMP 2000

Salary:	$25,530
Travel	1,088
Materials	1252
Operating Expenses	3,696
General Administration	3,157
Total	$34,722

Cost Share and matching funds:

Volunteer time contributions: $16,000+

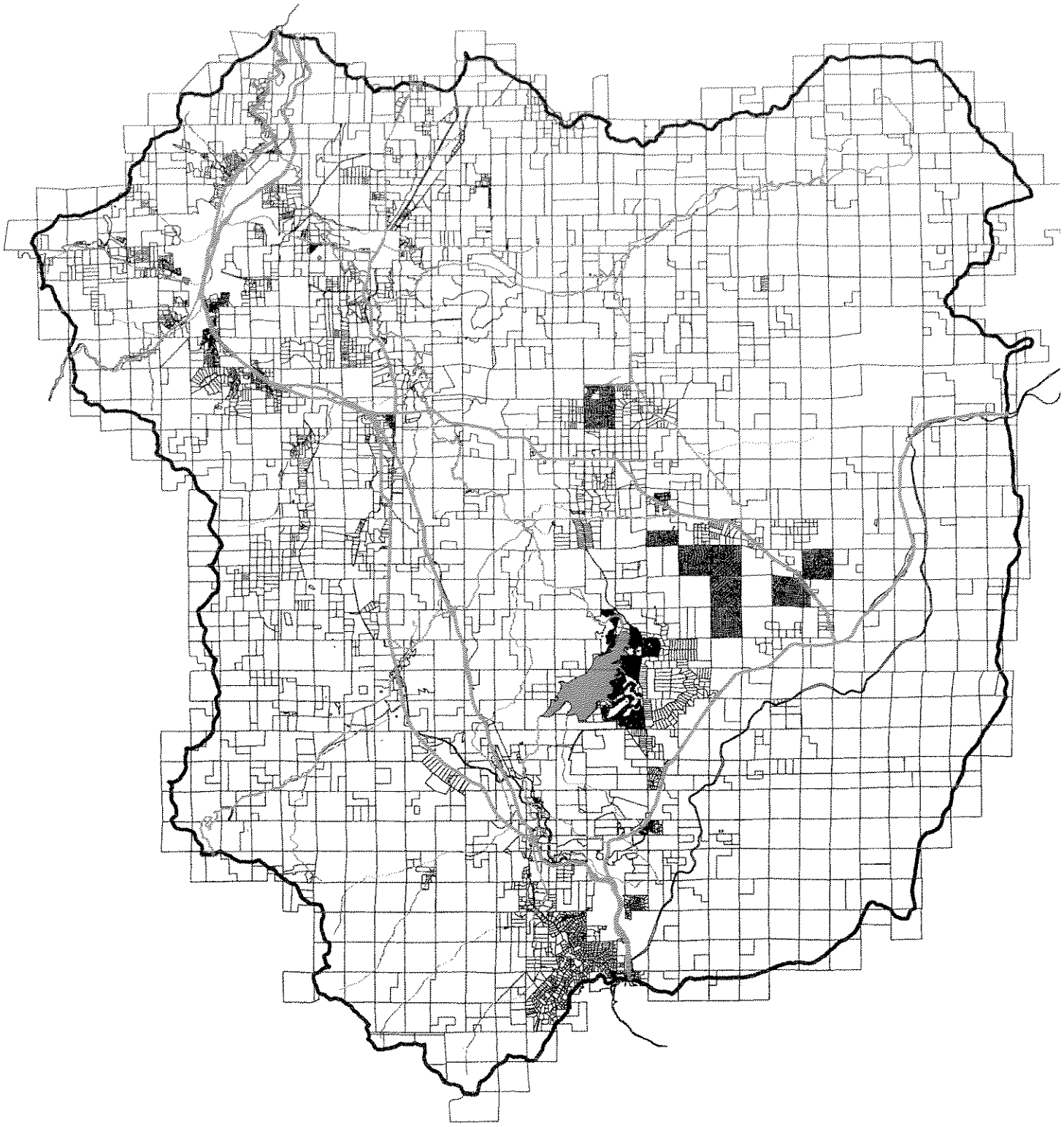
Attachment 1

Site	year	extent	problems/fixes
Anderson Grade Rd	1994	6/28 to 11/22	First data point of each day deleted as the previous day's date was associated with it.
Anderson Grade Rd	1995	3/6 to 11/21	Deleted 13 day block in August.
Anderson Grade Rd	1996	3/21 to 10/20	Block deleted at 5/21
Anderson Grade Rd	1997	3/11 to 11/10	time shifts at 7/4 to 8/4--fixed
Anderson Grade Rd	1998	4/10 to 11/4	none
Anderson Grade Rd	1999	8/18 to 12/31	none
Anderson Grade Rd	2000	1/1/00 to 10/22/00	Deleted block of data at 3/22.
Big Springs DWR Weir / Montague	1994	3/15 to 6/15	Had incorrect start time and date. Assigned start date based on field/data notes, assigned start time based on a best fit to expected diurnal patterns observed in other data sets for Shasta R.
Grenada Rd DWR Weir / Montague	1993	6/9 to 6/25	No time recorded. Was able to reconstruct intervals and start times based on records of other sites.
Grenada Rd DWR Weir / Montague	1994	7/15 to 11/22	Deleted data at front and end.
Grenada Rd DWR Weir / Montague	1995	6/6 to 11/21	Deleted block at 8/21 and other minor outliers.
Grenada Rd DWR Weir / Montague	1996	3/20 to 10/18	Several small blocks deleted. Data collected on short time intervals.
Grenada Rd DWR Weir / Montague	1997	3/23 to 11/6	Deleted set at front. Time shifted 12hrs forward at 7/1 to 8/8--fixed. Block of missing data 3/21 to 5/11 and 8/18 to 9/2.
Grenada Rd DWR Weir / Montague	1998	4/10 to 11/3	No anomalies
Grenada Rd DWR Weir / Montague	1999	3/18 to 10/12	none
Grenada Rd	2000	3/23 to 10/31	Deleted block of data at 8/4 to 8/7.
Edgewood	1996	6/12 to 8/25	none
Edgewood at Airport	1997	6/9 to 11/5	none
Edgewood	1998	4/10 to 11/3	none
Edgewood	1999	3/18 to 12/26/99	time shifts at 8/19--fix proposed. Overlap of data, temp jump at 10/12/99
Edgewood	2000	3/26/00 to11/13/00	Outliers deleted at 3/21. No data from mid Dec to mid Mar. Spike in temp at 7/13.
Grenada Irrigation Dist	1994	7/14 to 11/22	Deleted outliers at front and end.
Grenada Irrigation Dist	1995	6/6 to 11/21	Deleted data at 8/21.
Grenada Irrigation Dist	1996	3/24 to 8/5	Several spikes deleted. Block of missing temps from 4/18 to 5/21.
Grenada Irrigation Dist	1997	3/12 to 11/5	Deleted front and adjusted time after 7/1. Blank block of data 5/10 to 5/20.
Grenada Irrigation Dist	1998	5/29 to 11/3	Deleted data block from 6/22 to 6/28 as data looked "scattered."
Grenada Irrigation Dist	1999	3/18 to 10/13	none
Grenada Irrigation Dist	2000	3/23 to 5/9	broad peaks with nighttime high occur in April--no fix
Highway A-12	1993	6/9 to 6/30	No times recorded but reconstructed based on diurnal patterns of other sites of Shasta R
Highway A-12	1994	3/28 to 11/24	temp data.
Highway A-12	1995	2/28 to 11/21	Adjusted start times to better reflect diurnal patterns for block 3/29 to 6/27.
Highway A-12	1996	6/6 to 10/21	Deleted data at front, 6/5 and 8/21.
-lighway A-12	1997	3/21 to 11/4	Several outliers deleted. Block at end of set deleted. anomalous peaks occurring at night--no fix; 7/4 to 8/8 data was shifted 12 hrs forward--
lighway A-12	1998	4/10 to 11/3	fixed; data at front and back deleted (air temps) anomalous peaks occurring at night during spring and fall--no fix as this is thought to be
lighway A-12	1999	3/17 to 10/12	a real occurrence
lighway A-12	2000	1/1 to 11/1	none anomalous peaks occurring at night--no fix
ighway 263	1993	6/24 to 7/15	Start dates and start times were not recorded but I was able to reconstruct based on a summary table included with the data.
ighway 263	1994	4/6 to 11/22	Adjusted the start time for block of data 4/6 to 6/28. Original data had start time of 0:00. Adjustment based on best fit to diurnal pattern.
ghway 263	1995	3/6 to 11/21	Deleted data at 6/5 and 8/21. Large daily spikes that occur from 3/17 to 4/26 not deleted.
ghway 263	1996	3/24 to 10/21	Several single spikes of temp deleted. Temp collection intervals short (12 min) during
hway 263	1997	3/11 to 11/5	first half of year.
hway 263	1998	4/7 to 11/3	Front and tail deleted. 7/1 to 8/4 shifted back 12 hrs.
hway 263	1999	3/18 to 2/31	Outlier deleted at 6/7 and temps dropped lower here--no fix for temp drop.
hway 263	2000	1/1/00 to 10/6/00	none
			Deleteed outliers at 3/21.

Highway 3	1994	3/28 to 6/30	Adjusted the start time. Original data had start time of 0:00. Adjustment based on best fit to diurnal pattern.
Highway 3	1995	3/6 to 11/28	Deleted outliers at front, 6/5 and 8/21
Highway 3	1996	3/21 to 10/21	Several outliers deleted.
Highway 3	1997	3/21 to 11/5	Front deleted. 7/1 to 8/8 shifted back 12 hrs.
Highway 3	1998	8/18 to 11/3	No anomalies.
Highway 3	1999	3/21 to 12/31	deleted data on front
Highway 3	2000	1/1/00 to 10/31/00	Deleted outliers at 3/21. Relatively late peaks at night during October.
Hole in the Ground	1999	4/7 to 10/12	Three points at front deleted.
Louie Rd	1994	7/17 to 9/9	Deleted data at end. Data shifts to much smaller daily amplitudes in Sept--no edits.
Louie Rd	1995	5/17 to 8/15	Deleted data at front.
Louie Rd	1996	3/25 to 10/12	No anomalies.
Louie Rd	1998	4/6 to 11/4	Missing data at 6/23 to 7/5--no fix.
Louie Rd	1999	3/18 to 12/31	Deleted block at 8/8 to 8/12
Louie Rd	2000	1/1/00 to 10/31/00	Deleted outliers at 3/21.
Mouth	1994	3/30 to 12/31/94	Adjusted start times for 3/29 to 7/2 to better reflect diurnal patterns. Original start time was 0:00.Deleted outliers on 3/29 and 3/30; 9/7 and 11/22;. Data gap 7/2 through 9/30
Mouth	1995	1/1 to 12/31	Outliers deleted on 11/30. Data with large gaps
Mouth	1996	1/1/96 to 12/31/96	Outliers deleted 3/25 thru 26 and 5/20 thru 5/22; large data gaps
Mouth	1997	3/21 to 11/6	Deleted front. 7/1 to 8/4 was time shifted forward 12 hrs--fixed.
Mouth	1998	5/20 to 11/3	deleted outliers 11/3/98
Mouth	1999	3/19 to 12/31	Formatting inconsistencies not corrected
Mouth	2000	1/1/00 to 10/5/00	No anomalies.
Parks Cr	1997	6/10 to 10/31	Deleted front. 7/3 to 8/4 shifted back 12 hrs. Deleted block 7/25 to 7/28 as temps looked too low.
Parks Cr	1999	4/8 to 10/12	none
Parks Cr	2000	5/8 to 8/27	No daily variation after 8/26 therefore deleted.
Riverside	1994	3/26 to 8/30	Adjusted start times for 3/26 to 5/15 to better reflect diurnal patterns. Original start time was 0:00.
Riverside	1995	2/28 to 9/10	Deleted data at 3/20 to 3/24, 6/6 to 6/7, 8/21, and all data after 9/10. There seemed to be some problems with Hobo coming out of water...
Riverside	1996	3/22 to 6/20	Deleted few hours at front and several spikes.
Riverside	1997	6/11 to 10/31	Deleted several spiked outliers. Data were shifted in July Aug. Double peaks evident.
Riverside	1998	5/20 to 11/3	Front end deleted. Black cells deleted. Same data as Hole Riverside 1998?
Riverside	1999	3/19 to 12/26	Data at 8/18 phase shifted 24 hours back.
Riverside	2000	3/23 to 5/9/00	Outliers deleted at 3/23 and 5/8. Large block of missing data 12/26/99 to 3/16/00.
Yreka Ager Rd	1994	3/26 to 11/22	Generated start time and intervals for block 3/26 to 6/28 as no times were recorded. Based generated times on those used for other sites in 1994.
Yreka Ager Rd	1995	3/6 to 11/21	Deleted data at 6/6 and 8/21.
Yreka Ager Rd	1996	3/28 to 10/20	Deleted block at front and several outliers.
Yreka Ager Rd	1997	3/12 to 11/4	Deleted front data, blanks and outliers. Time shifted back 12 hrs at 7/1 to 8/8.
Yreka Ager Rd	1998	4/8 to 11/3	Deleted blanks, block of missing data at 5/8 to 7/22.
Yreka Ager Rd	1999	3/18 to 10/12	Outliers deleted at 6/28 and 8/18
Yreka Ager Rd	2000	3/22 to 11/1	missing block of data 5/5 to 5/9--no fix; some suggestion of nighttime peaks during April and Sept-Oct--no fix
z DWR data at mouth		1994-00	No changes attempted
zz Old USGS data at mouth		1966-1978	No changes attempted. USGS std +- 2*C. Mercury sensors easily within 1*C
zzz Old DWR data from Storet files		1950-1985	Many locations, grab samples. No corrections attempted.

Attachment 2

Shasta River Watershed
Assesors Parcels



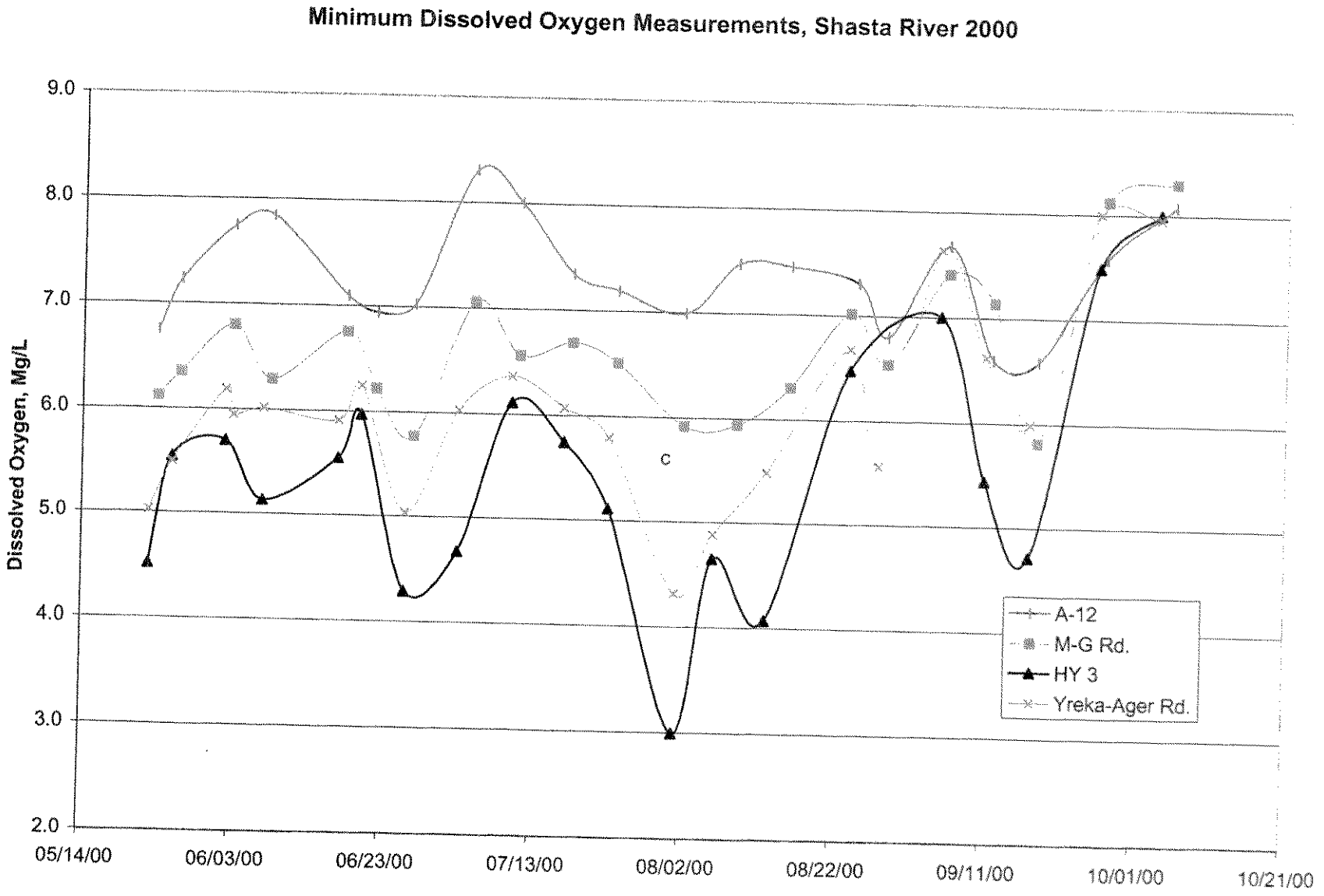
Shasta Watershed

Topic-_____ Reviewer_____

Technical Workgroup Tour Stops
Shasta Watershed 2000

Attachment 3

ID number	Location	Description
1	USFS Yreka	Start and end
2	Raley's and Yreka Creek	Lunches and redd in creek
3	Yreka-Ager Rd. BR.	Flock fences, dam, pump, mined channel
4	Oregon Slough	small stream that we crossed but did not stop at.
5	Montague Grenada Rd. Br.	Fencing, watermasters weir, 1 cfs diversion, tailwater capture
6	Julian Creek	small creek we crossed but did not stop at
7	A12 Br.	Meanders, fencing challenges, grazing intensity comparison
8	Willow Creek	Running beside Hy, first in nat. channel, then in ditch by Caltrans
9	Willow Creek	small gravel and silt bottom, low gradient channel (hunters near road)
10	Willow Creek	Open channel, large qty of spawning size granitic gravel
11	Parks Creek	Granitic gravels, small berms from channel maint, near Parks Crk Divers.
12	Shasta R & mouth of Boles Crk	Channelized, aggraded, blown-out
13	Parks Creek	Back to Upper Parks Crk via Stewart Springs Rd.
14	Parks Creek diversion canal	canal perpendicular to Hy from west to east, then dn. over hill
15	Shasta River near Edgewood	DWR gauge location, more gravel, enc of COE channelization
16	Carrick Crk	small stream that we crossed but did not stop at.
17	Dwinnell Dam	Lunch, Montague Irrigation District Canal
18	Louie Rd Br.	Shasta 1/8 mile above Big Springs Creek
19	Big Springs Lake	Edge of Pluto's Cave Basalt, lava tubes, 60 cfs spring in lake
20	Little Shasta	Little Shasta R and Montague ID Canal, Volcanic gravels upstream
21	Little Shasta	Refugia area
22	Little Shasta	Fish Screen on DFG diversion from Little Shasta
23	Shasta River	Crossed but did not stop


Minimum Dissolved Oxygen Measurements, Shasta River 2000
Dissolved Oxygen, Mg/L
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
05/14/00
06/03/00
06/23/00
07/13/00
08/02/00
08/22/00
09/11/00
10/01/00
10/21/00
A-12
M-G Rd.
HY 3
Yreka-Ager Rd.

Water quality, flows and fish numbers—Looking for correlations in the Shasta River.

Concern for water quality (especially temperatures) is focused primarily around meeting the needs of coho and chinook salmon and also steelhead. The recent listing of coho, and the near listing of steelhead, along with the pending development of an attainment plan for the Shasta to meet the mandates of the Clean Water Act (establishment of TMDLs) have all sharpened the focus on water quality, and necessitated a review of the present conditions and trends in the Shasta River. How well we are doing in these areas will have significant effects on land and water uses in the Shasta Valley in the future.

Ideally, we would be looking at conditions in a way that is specific for the main species of concern—coho and steelhead. Unfortunately, while both coho and steelhead are present in the Shasta, their timing, currently low numbers, and lack of reliable data effectively prevent us from using them as an index of success. The best we have available is the information on fall chinook.

There are several important differences in the life histories of chinook, coho and steelhead. Chinook mostly leave the Shasta River for the ocean in the spring and early summer. Very few remain in the Shasta through the summer before leaving. Coho, on the other hand, must spend at least their first year in fresh water, and apparently don't leave the Shasta until they are about a year old. That means that they must have suitable conditions through one entire summer in order to survive.

Steelhead have even more difficult requirements to meet. They may stay in the Shasta for two or more years before leaving for the ocean, making the necessity of good water quality all summer even more important. Steelhead leave the Shasta in the late spring and early summer. They formed the foundation of a commercial fishery in the Shasta in the 1860's, and also made the Shasta the most heavily sport-fished stream in Siskiyou County in the 1950's and 1960's.

Data available:

The US Geological Survey has been collecting river flow data near the mouth of the Shasta since 1934. Before that they collected flow data intermittently from 1912-1933 where the Montague-Grenada Road crosses the Shasta. They also collected maximum and minimum temperatures between 1965 and 1979 near the mouth of the Shasta, and flow data near Edgewood above Dwinnell Dam from 1963-67. DWR has been operating gaging stations at both the Montague-Grenada Rd., and near Edgewood since they were abandoned by USGS.

The California Department of Fish and Game (DFG), Shasta CRMP (CRMP), California Department of Water Resources (DWR), and North Coast Regional Water Quality Control Board (RWQCB) have collected extensive sets of temperature data, some of it in the form of grab samples, and some in continuous form collected over many months. Their records span the period from the 1950's through the present, although continuous data was only being collected starting in the mid-1990's.

Other water quality testing, including nutrients, dissolved oxygen, and minerals has been done intermittently in the form of grab samples, mostly by DWR and RWQCB, from the 1950's through the present.

The DFG has been counting spawning fall chinook salmon in the Shasta since 1930, and also counted the steelhead and coho who came through while the fall chinook were being counted. They did some trapping and counting of outmigrating juvenile chinook in the 1960's to establish outmigration timing, trapped and tagged outmigrating juvenile chinook salmon in the late 1980's, but only began systematically counting outmigrants in an effort to estimate total outmigrant numbers in 2000.

Temperature trends in the Shasta

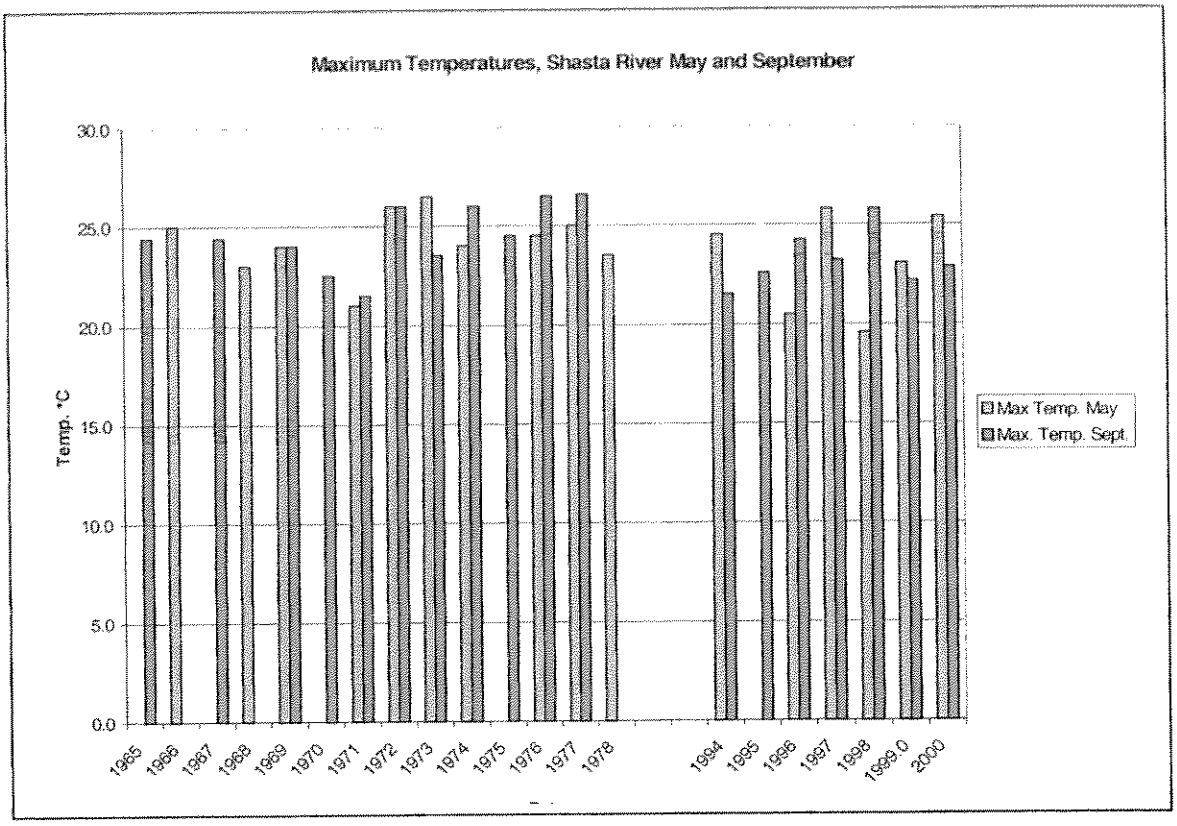
At the present time, river temperature information is being gathered at well over a dozen sites throughout the Shasta Valley (see attachment 1). Utilizing funding from this grant, all of the recent (1994-present) temperature data has been assembled into annual data sets for possible analysis. Prior to 1994, the only data that was being collected on a continuous basis over any time period was from the mouth of the Shasta (collected by USGS). That data, along with an array of single instance grab samples was also entered into electronic form for possible future use as part of this effort. To look at trends over time, the only site where we can make useful comparisons is at the mouth of the Shasta where data spanning many years is available.

The USGS data spans 14 years (1965-78). Recent continuous data covers 7 years. In order to make meaningful comparisons that could be readily followed and understood, the data examined needed to be somehow limited. I chose to use the months of May and September (see attachments 2 and 3) as indicators of change over time when conditions were at or near critical.

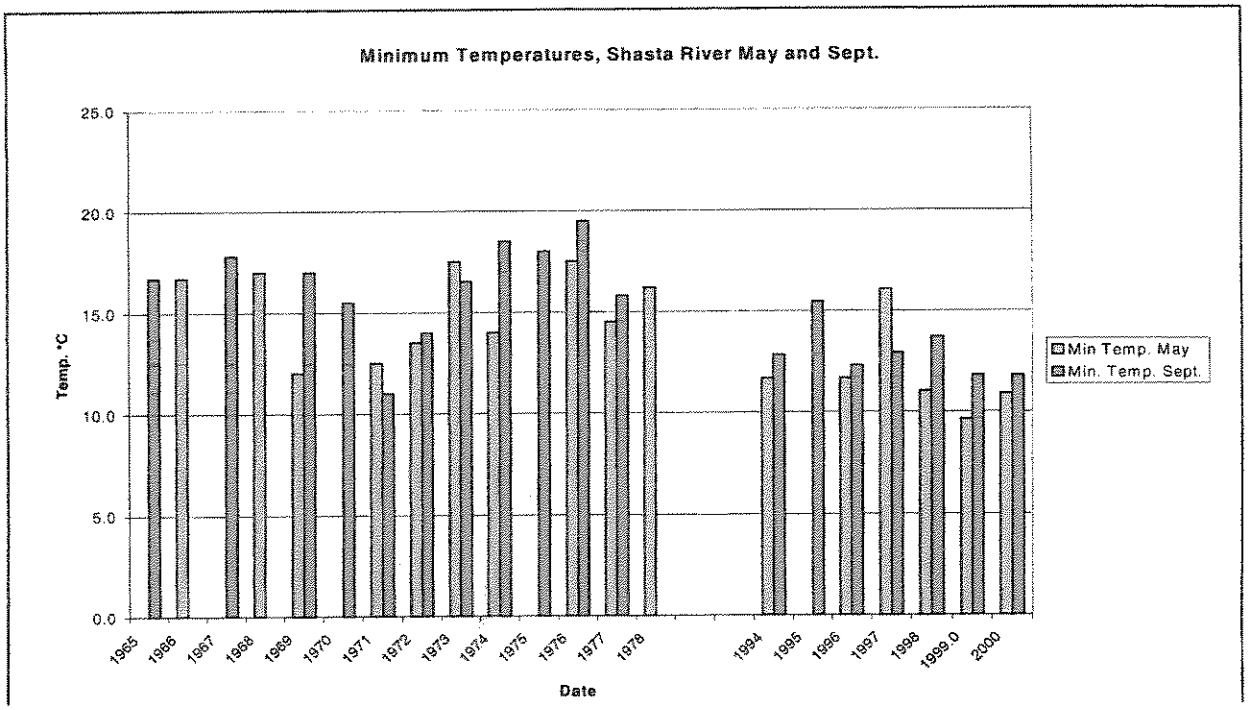
Water temperatures in May can approach lethal, affecting both outmigrating and oversummering juveniles. By June, water temperatures at the mouth have generally begun to reach lethal temperatures intermittently. May seemed like a good index month, in which any change since the 1960's would be both apparent and significant.

September is also a critical month, primarily for returning fall chinook. High water temperatures can limit entry into the Shasta, reduce egg survival, limit spawner dispersal, and increase inriver mortality. It is a month when the purchase of water for increased instream flows could be beneficial to at least fall chinook. By October, night temperatures are dropping, and river flows have increased with the end of the irrigation season. September also seems like a month when changes over time would be both apparent and significant.

USGS data is limited to maximum and minimum daily temperatures. More recent data can be compared on those two parameters for indications of trends over the last 35 years, a time period when fall chinook coho and steelhead numbers plummeted. The data from 1994 to the present corresponds to a time when substantial work has been started to improve water temperatures, although insufficient time has elapsed to expect much change to be apparent.



Visually, there appears to be a break in the USGS temperature values occurring between 1971 and 1972. What, if anything beyond normal weather patterns this represents is unclear. The temperatures from 1994 to the present seem to be similar to the values from 1965-78. It should be noted that the data sets for May 70, May 75, Sept 95, May 96, and May 98 cover substantially less than full months (see attachment 4).



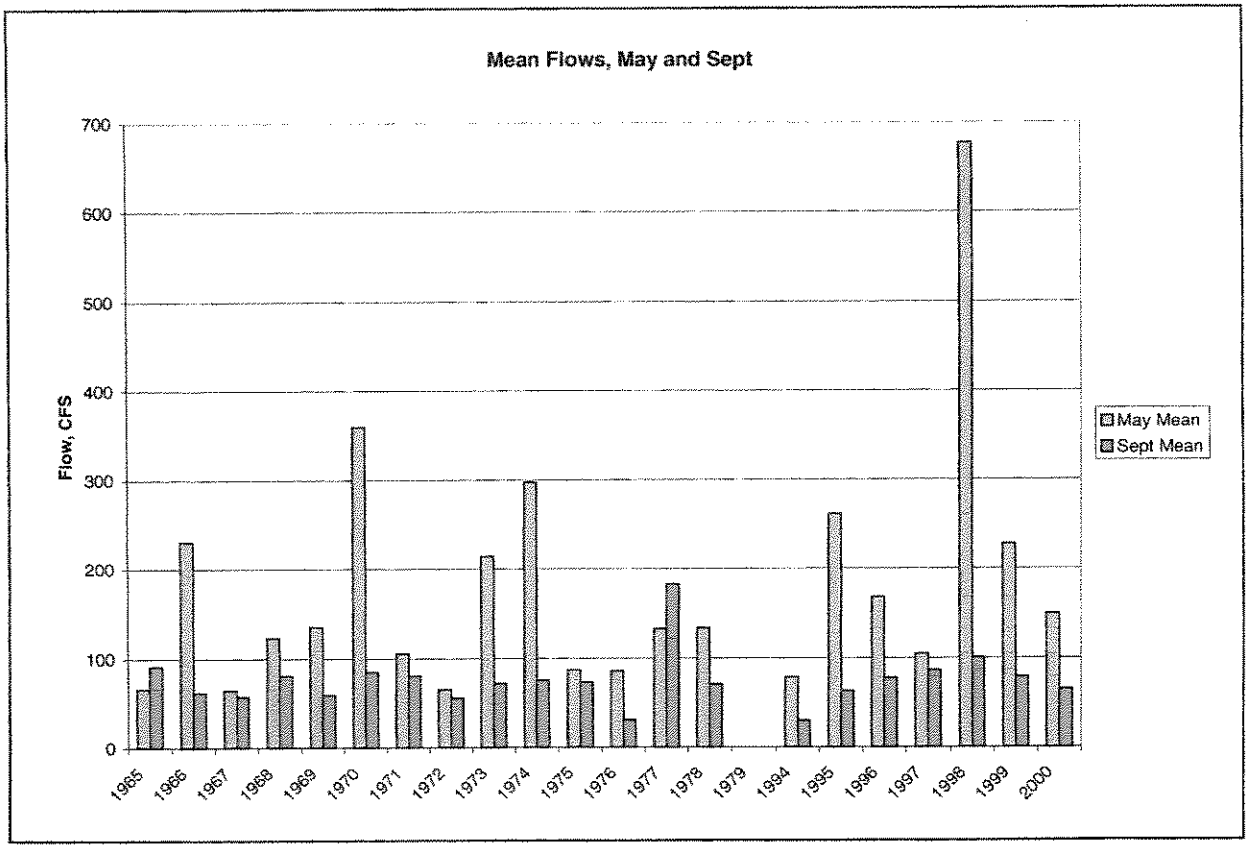
Minimum temperature values show a definite trend towards cooler temperatures. Why this would be is not clear. The above mentioned data limitations limit interpretations. Possible explanations include:

1. Changes in vegetation in the canyon—possibly increased tree heights reduce heat radiated from canyon walls, but still allow the river to radiate heat to the sky at night while the river reaches equilibrium during the day during the entire period of record (hence no change in maximum temps).
2. Reduced stream flows, allowing greater cooling at night, while the river reaches equilibrium during the day during the entire period of record (hence no change in maximum temps.)
3. Decreased shading on the Shasta River in the open areas of the Shasta Valley, allowing greater radiation of heat at night, while the river reaches equilibrium during the day during the entire period of record (hence no change in maximum temps.)
4. Climatic change resulting in cooler, windier or clearer nights, allowing greater heat loss.

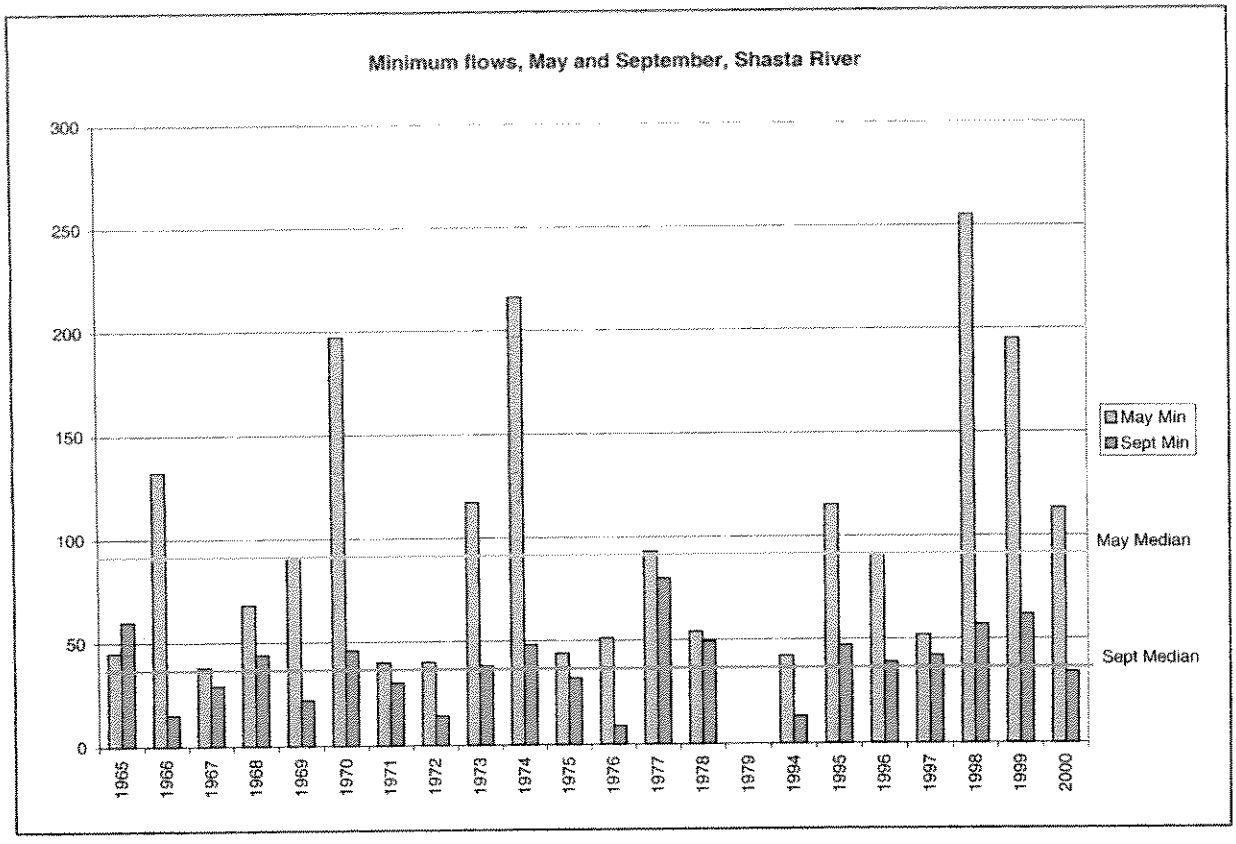
The absence of long-term upstream data, average temperature data from the 60's and 70's, or data over a longer period of time makes any conclusions speculative. Data on air temperatures would also be helpful, and could be researched.

Flow Data

Flow data for the months studied is complete (see attachment 5). Most noteworthy is the extremely high flows observed in May of 1998 (highest on record). Other than that, mean monthly flows have tended to be in the normal range, with their average apparently somewhat higher than normal. September in particular shows the effect of the long series of wet years with good snowpack beginning about 1995.

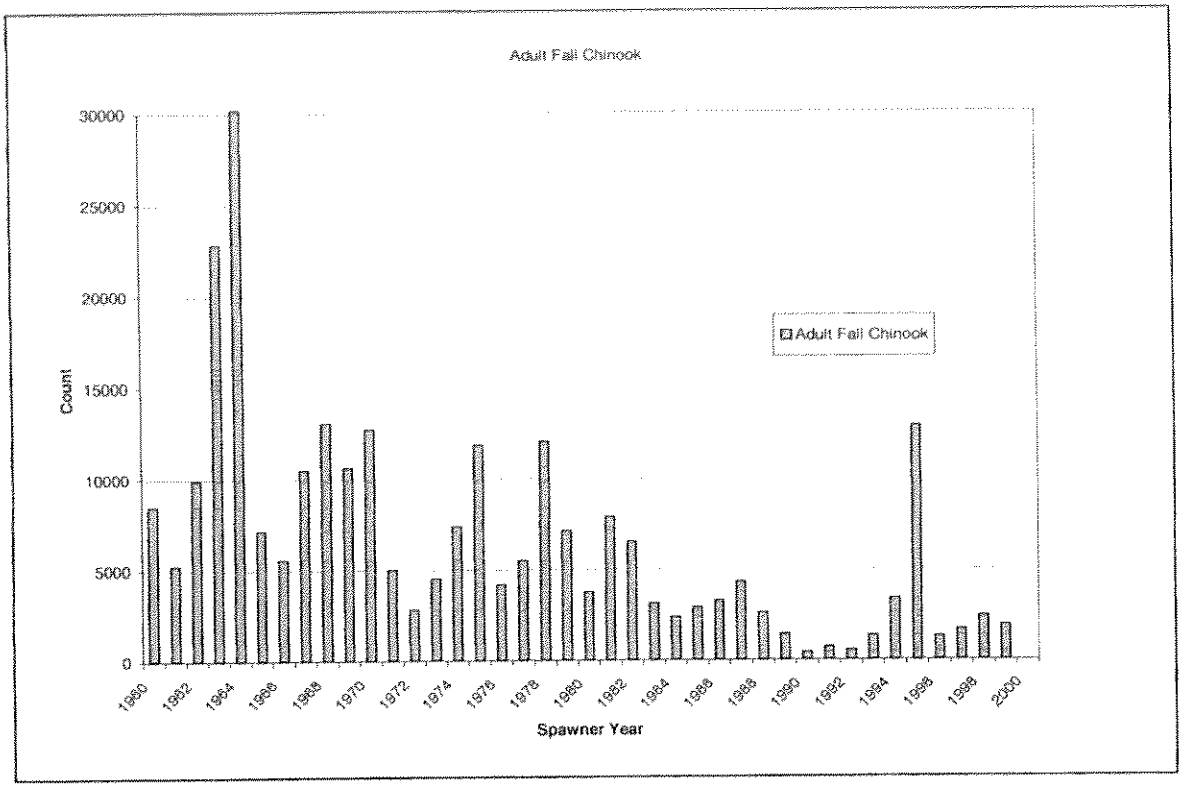


Minimum flows for the months studied show more strongly that the range of minimum September flows since 1994 have tended to be above the values found between 1965 and 1978. This is consistent with the shift in weather towards wetter years, and also may indicate greater attention to maintaining instream flows by water managers. Conclusions for May are similar.



Fall Chinook spawner numbers

Spawner counts for this period are also complete (see attachment 6). Unfortunately, fall chinook return to spawn at ages 2,3,4,and 5 years, and for most of the period of record, the only distinctions made were between 2 year olds, and adults. This makes it difficult to examine water conditions for either the parent years in a given spawner run, or the progeny of that run when they return. This difficulty is further compounded by changes in fishing that have occurred during this time. Harvest impacts take an unknown percentage of each year class of Shasta salmon, and harvest has shifted from primarily occurring in the ocean, to the current situation where it is intended to be split equally between the ocean and that which occurs in the Klamath River. In-river harvest in particular has the potential to impact early running fish, like those returning to the Shasta. Finally, conditions in the Klamath and in the ocean can vary greatly from year to year, further confounding an evaluation of the effects of water quality within the Shasta itself.



Given all of the above limitations, still the bulk of the adult salmon return at ages 3 and 4. Spawner numbers could be compared to water conditions in the fall 3 and 4 years prior to the date they return to spawn to look for water quality impacts on the parent run, and three and four years later to look at water quality impacts at the time of spawning may have been on the progeny as they return as adults. Finally, water quality the year after spawning would affect the survival of the juvenile fish as they outmigrate to the sea, and so could be compared to spawner returns 2 ½ and 3 ½ years later[1].

It also needs to be noted, that high winter flows (while salmon eggs are in the river gravel, or the salmon have just emerged (roughly October through February for fall chinook) can have much more profound impacts on overall survival, and that those impacts will not be discernable from summer water quantity and quality data.

Given these multiple overlapping variables, most of which cannot be well described with available data, there seems to be little point in attempting to analyze each of them at this point.

Conclusions

Water temperatures, spawner returns and mean daily flow data are all fairly robust data sets, although water temperature data for a longer time frame would have been extremely

[1] Calendar year 2000 is the last period for which any spawner information is available. Age analysis was not systematically initiated until the 1980's. Those salmon that returned at age four in 2000 came from eggs laid in 1996, and they almost certainly outmigrated in the spring and summer of 1997. Hence, the only period for which reasonably complete information could be available is the period from 1994 (when recent water quality data collection began) and the spring and early summer of 1997, when the bulk of the outmigration would have been complete, much too short period in which to try to weigh all the competing climatological, water quality, ocean condition, and harvest factors that are operating simultaneously.

helpful, as would historic data from further upstream in the Shasta. Both water temperatures and flows seem to show a slight improving trend as far as fish are concerned. What this is a result of is not clear at this time. Possibilities include improvements in riparian habitat, higher than normal precipitation, climatic shift, or changes in water management. Whatever the case, the fact that conditions have not gotten worse should be viewed as significant, since this was a time period when irrigation related equipment and infrastructure[2] has improved, population has risen, and one would expect that demands on resources, including water, would have gotten greater.

Realistically, there are far too many other variables to allow accurately assessing the water quality impacts on recent fish numbers with the limited duration data currently available on flow, temperature or spawner numbers. Efforts to present assumptions based on these factors should continue to be questioned closely until either a better accounting is possible of all life stage impacts on fish survival, or outmigrant numbers data can be used to eliminate out-of-basin impacts. At the same time, the fact that there is apparently no correlation that is so strong that it overrides all other factors cannot be taken as proof that there are no water quality related impacts that could be reduced. It continues to appear that no single factor can be responsible for fish declines, and no single remedial action will restore their numbers.

Recommendations:

The continued gathering of outmigrant data is critical to our ever having the opportunity of evaluating fisheries restoration progress in the Shasta, and needs to be continued indefinitely. The development of a total outmigrant estimate should continue to be a goal of the program. Likewise, temperature data can and should continue be gathered at key locations along the river. Other water quality parameters than temperature need to be looked at to eliminate them as possible mortality factors.

Given the apparent absence of a strong correlation between fish numbers and changes in conditions in the Shasta (at least in the limited data examined here)[3], increased emphasis should be placed on investigations outside the Shasta Basin to better understand the sources of the variability in fish numbers observed. Fuller understanding of all the sources of variability is needed to develop the most effective mechanisms to increase fish numbers.

While current conditions in the Shasta are apparently long-standing in nature, opportunities for improvement should be aggressively pursued in order to assure that bottlenecks are not developing or occurring within the watershed.

Additional data may or does exist that could help to clarify trends, including long term climatic data for the Yreka area (1878-present), and temperature data collected by DFG counting weir operators during the 1950's[4], and possibly earlier.

---

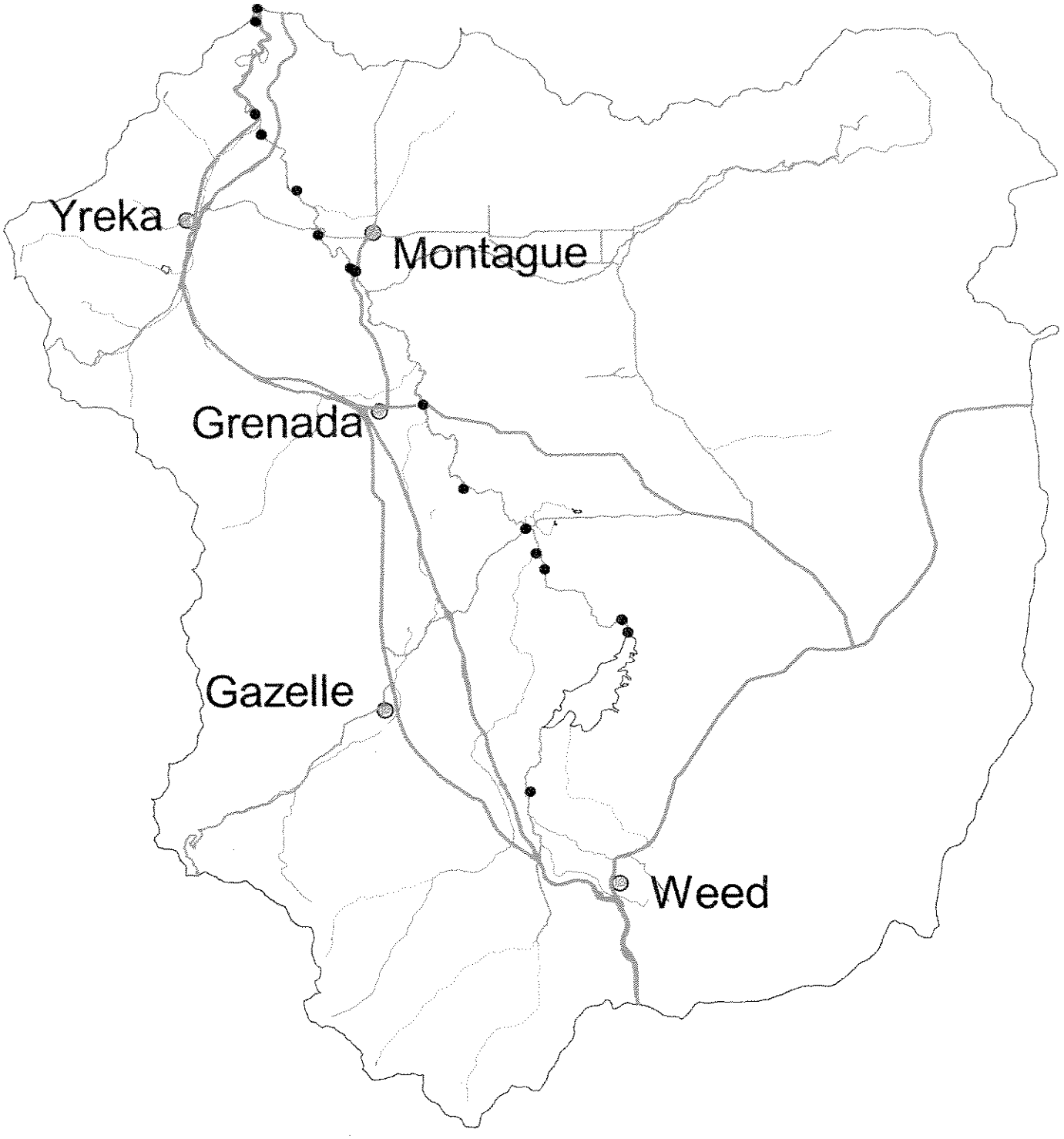
[2] Including the widespread ownership of backhoes and dump trucks, and the availability of relatively lower cost plastic pipes and culverts.

[3] Full electronic temperature datasets were submitted with this report to allow others to perform more extensive analysis.

[4] Administrative reports by Coots beginning about 1950 mention water temperatures without providing the data. Efforts to find that data have been unsuccessful to date.

Attachment 1

Primary Temperature Monitoring Locations in Shasta River Watershed



Daily Temperature Values

Mouth of Shasta, 1994-2000

Attachment 2

Mouth of Shasta, May and September Data																			
		Celsius					Celsius					Celsius					Celsius		
Date	Maximum	Minimum	Mean		Date	Maximum	Minimum	Mean		Date	Maximum	Minimum	Mean		Date	Maximum	Minimum	Mean	
05/01/1994	16.2	11.98	14.45333							09/01/1995	22.27	16.91	19.4965		09/01/1996	24.23	18.12	21.05667	
05/02/1994	17.81	11.68	14.76267							09/02/1995	21.61	16.26	18.9805		09/02/1996	24.23	18.12	20.93771	
05/03/1994	16.53	13.76	15.31667							09/03/1995	20.45	15.46	18.106		09/03/1996	23.03	17.63	20.34688	
05/04/1994	15.89	13.76	14.986							09/04/1995	20.78	15.63	18.101		09/04/1996	21.04	16.68	18.69906	
05/05/1994	17.16	13.15	15.27533							09/05/1995	21.1	15.46	18.3025		09/05/1996	20.22	14.78	17.46719	
05/06/1994	17.16	14.65	15.83533							09/06/1995	21.44	15.94	18.769		09/06/1996	20.54	14.16	17.29844	
05/07/1994	19.13	14.35	16.57467		09/07/1994	21.54	18.8	20.43909		09/07/1995	21.29	16.4	18.817		09/07/1996	21.04	14.63	17.92365	
05/08/1994	21.21	15.89	18.352		09/08/1994	21.21	16.82	18.9495		09/08/1995	21.1	15.94	18.5955		09/08/1996	22.2	16.05	19.12677	
05/09/1994	22.62	17.48	19.87133		09/09/1994	18.8	15.57	17.3625		09/09/1995	21.44	16.26	18.9025		09/09/1996	23.2	16.84	20.02635	
05/10/1994	23.72	17.81	20.614		09/10/1994	18.15	14.96	16.5475		09/10/1995	21.94	16.71	19.293		09/10/1996	23.37	17.32	20.23823	
05/11/1994	23.35	18.47	20.82733		09/11/1994	17.16	14.96	15.863		09/11/1995	22.27	16.91	19.59		09/11/1996	20.87	16.68	18.80979	
05/12/1994	22.27	17.16	19.77467		09/12/1994	17.48	13.15	15.4275		09/12/1995	22.59	17.04	19.8435		09/12/1996	18.76	15.89	17.355	
05/13/1994	21.54	15.89	18.722		09/13/1994	17.81	12.85	15.4775		09/13/1995	21.44	17.35	19.05308		09/13/1996	17.16	15.42	16.44604	
05/14/1994	20.5	16.2	18.11467		09/14/1994	18.15	13.46	15.905		09/14/1995					09/14/1996	17.63	14.16	15.81177	
05/15/1994	17.81	14.35	16.194		09/15/1994	18.8	14.04	16.631		09/15/1995					09/15/1996	18.12	15.89	16.62229	
05/16/1994	16.82	13.46	14.91		09/16/1994	19.79	14.35	17.081		09/16/1995					09/16/1996	16.84	14.47	15.57854	
05/17/1994	16.82	11.98	14.13333		09/17/1994	19.13	14.96	17.281		09/17/1995					09/17/1996	16.21	13.69	14.80583	
05/18/1994	17.16	12.28	14.868		09/18/1994	20.15	14.96	17.626		09/18/1995					09/18/1996	16.84	12.3	14.53854	
05/19/1994	17.81	13.76	15.65867		09/19/1994	20.5	15.57	17.9645		09/19/1995					09/19/1996	18.6	14.47	16.2726	
05/20/1994	18.47	14.04	16.21067		09/20/1994	20.15	16.2	18.1225		09/20/1995					09/20/1996	18.6	14.31	16.51271	
05/21/1994	17.16	14.96	16.208		09/21/1994	20.5	16.2	18.2235		09/21/1995					09/21/1996	18.93	15.26	16.88052	
05/22/1994	20.15	13.46	16.544		09/22/1994	20.15	16.53	18.1315		09/22/1995					09/22/1996	17	13.23	15.07563	
05/23/1994	21.9	15.57	18.612		09/23/1994	19.46	15.89	17.6945		09/23/1995					09/23/1996	16.68	12.3	14.35927	
05/24/1994	24.13	17.48	20.56333		09/24/1994	18.8	15.89	17.59		09/24/1995					09/24/1996	17.16	12.61	14.6901	
05/25/1994	24.51	19.13	21.63067		09/25/1994	19.46	16.2	18.1985		09/25/1995					09/25/1996	17.32	13.23	15.11125	
05/26/1994	21.21	18.8	20.11733		09/26/1994	20.15	15.89	18.0745		09/26/1995					09/26/1996	17.47	13.54	15.40229	
05/27/1994	21.9	16.2	18.95267		09/27/1994	18.8	15.89	17.7555		09/27/1995					09/27/1996	18.28	13.69	15.84448	
05/28/1994	21.54	16.53	18.94333		09/28/1994	18.8	16.82	17.829		09/28/1995					09/28/1996	18.6	14	16.12708	
05/29/1994	21.54	16.53	18.986		09/29/1994	17.48	15.57	16.663		09/29/1995					09/29/1996	18.93	14.47	16.61167	
05/30/1994	23.01	15.89	19.43467		09/30/1994	17.16	14.35	16.0545		09/30/1995					09/30/1996	18.44	15.42	16.73823	
05/31/1994	22.27	19.13	20.48333																
Mean			17.6					17.4					18.9					17.1	
Min		11.68					12.85					15.46					12.3		
Max	24.51					21.54					22.59					24.23			

Daily Temperature Values

Mouth of Shasta, 1994-2000

Attachment 2

		Celsius					Celsius					Celsius					Celsius	
Date	Maximu	Minimum	Mean	Date	Maximu	Minimum	Mean	Date	Maximum	Minimum	Mean	Date	Maximu	Minimum	Mean	Date	Maximu	Minimum	Mean
05/01/1997	16.7	11.4	13.8	09/01/1997	23.1	18.0	20.4	05/01/1998				09/01/1998	25.3	19.3	22.3				
05/02/1997	16.7	11.9	13.9	09/02/1997	23.2	17.7	20.1	05/02/1998				09/02/1998	25.7	19.8	22.7				
05/03/1997	18.3	13.3	15.2	09/03/1997	22.4	17.2	19.7	05/03/1998				09/03/1998	25.8	20.2	23.0				
05/04/1997	17.8	12.2	14.9	09/04/1997	23.2	17.7	20.3	05/04/1998				09/04/1998	25.8	20.7	23.3				
05/05/1997	19.4	13.6	16.1	09/05/1997	23.2	17.7	20.2	05/05/1998				09/05/1998	24.6	21.2	22.9				
05/06/1997	20.2	14.3	16.8	09/06/1997	23.1	17.3	20.0	05/06/1998				09/06/1998	23.7	19.6	21.7				
05/07/1997	21.1	14.3	17.3	09/07/1997	22.9	16.9	19.7	05/07/1998				09/07/1998	22.9	20.7	21.9				
05/08/1997	21.9	15.3	18.3	09/08/1997	21.7	16.5	19.0	05/08/1998				09/08/1998	22.1	19.0	20.6				
05/09/1997	23.1	16.1	19.2	09/09/1997	20.4	17.0	18.9	05/09/1998				09/09/1998	20.2	17.7	18.9				
05/10/1997	23.6	16.7	19.9	09/10/1997	22.1	16.9	19.1	05/10/1998				09/10/1998	20.9	15.9	18.2				
05/11/1997	25.0	17.7	21.0	09/11/1997	20.9	17.3	19.0	05/11/1998				09/11/1998	21.2	15.8	18.4				
05/12/1997	25.1	18.3	21.3	09/12/1997	21.7	16.7	19.0	05/12/1998				09/12/1998	21.9	16.5	19.1				
05/13/1997	23.7	18.0	20.8	09/13/1997	20.4	16.4	18.5	05/13/1998				09/13/1998	22.4	17.0	19.6				
05/14/1997	22.4	18.5	20.3	09/14/1997	18.1	15.9	17.0	05/14/1998				09/14/1998	22.7	17.2	19.9				
05/15/1997	23.7	18.5	20.7	09/15/1997	16.2	14.6	15.4	05/15/1998				09/15/1998	22.9	17.7	20.2				
05/16/1997	24.3	18.0	20.9	09/16/1997	17.8	13.9	15.7	05/16/1998				09/16/1998	22.2	17.5	19.8				
05/17/1997	25.3	18.0	21.5	09/17/1997	17.8	15.0	16.1	05/17/1998				09/17/1998	20.9	16.9	18.6				
05/18/1997	25.8	18.3	21.8	09/18/1997	17.3	13.1	15.0	05/18/1998				09/18/1998	18.6	15.8	17.0				
05/19/1997	25.1	18.1	21.3	09/19/1997	17.8	12.9	15.1	05/19/1998				09/19/1998	18.3	14.2	16.2				
05/20/1997	24.1	17.5	20.4	09/20/1997	18.5	13.3	15.6	05/20/1998	12.28	11.04	12.00143	09/20/1998	18.6	13.7	16.1				
05/21/1997	23.1	15.8	19.3	09/21/1997	19.0	13.4	16.0	05/21/1998	14.76	11.34	12.79375	09/21/1998	19.0	14.0	16.3				
05/22/1997	19.3	16.1	17.7	09/22/1997	19.4	14.0	16.7	05/22/1998	16.98	12.74	14.88458	09/22/1998	18.8	13.7	16.1				
05/23/1997	19.3	15.8	17.3	09/23/1997	19.6	14.3	16.9	05/23/1998	17.46	15.4	16.46875	09/23/1998	18.6	13.7	16.2				
05/24/1997	20.6	14.6	17.1	09/24/1997	19.8	14.6	17.0	05/24/1998	16.82	14.44	15.50417	09/24/1998	18.8	14.0	16.3				
05/25/1997	21.1	13.4	17.0	09/25/1997	19.3	15.0	17.0	05/25/1998	14.13	12.28	13.2725	09/25/1998	18.0	15.4	16.6				
05/26/1997	19.3	15.4	17.1	09/26/1997	19.0	15.4	16.9	05/26/1998	13.21	11.66	12.39417	09/26/1998	17.0	13.9	15.5				
05/27/1997	20.6	16.1	18.2	09/27/1997	17.5	13.1	15.3	05/27/1998	13.98	11.34	12.55292	09/27/1998	18.1	14.0	15.8				
05/28/1997	20.2	17.5	18.7	09/28/1997	18.0	13.3	15.5	05/28/1998	13.98	12.74	13.34375	09/28/1998	17.7	14.5	15.8				
05/29/1997	23.2	16.7	19.8	09/29/1997	18.5	13.4	15.8	05/29/1998	12.9	11.19	12.14708	09/29/1998	18.3	14.5	16.1				
05/30/1997	25.5	18.1	21.6	09/30/1997	17.2	14.3	15.7	05/30/1998	17.14	12.43	14.53833	09/30/1998	18.5	14.6	16.3				
05/31/1997	22.9	18.8	20.8					05/31/1998	19.57	15.08	17.28125								
			18.7				17.5				13.9				18.7				
		11.38				12.94				11.04				13.71					
	25.82				23.23				19.57				25.82						

Daily Temperature Values

Mouth of Shasta, 1994-2000

Attachment 2

NBS data from Sharon Campbell

		Celsius				Celsius				Celsius				Celsius	
Date	Maximum	Minimum	Mean	Date	Maximum	Minimum	Mean	Date	Maximum	Minimum	Mean	Date	Maximum	Minimum	Mean
05/01/1999	17.2	13.4	15.0	09/01/1999	19.9	13.53	16.68688	05/01/2000	16.83	13.84	15.21583	09/01/2000	19.9	17.0	18.2
05/02/1999	14.5	12.1	12.9	09/02/1999	20.54	14.46	17.33646	05/02/2000	18.11	13.07	15.29667	09/02/2000	17.8	14.9	16.2
05/03/1999	13.8	10.6	12.0	09/03/1999	20.71	14.77	17.62313	05/03/2000	18.27	14.46	15.9175	09/03/2000	16.9	14.1	16.5
05/04/1999	14.3	9.7	11.6	09/04/1999	21.03	14.62	17.79292	05/04/2000	17.63	13.84	15.45063	09/04/2000	17.9	14.8	16.3
05/05/1999	16.3	10.2	13.1	09/05/1999	21.87	15.57	18.6975	05/05/2000	17.31	12.76	14.98083	09/05/2000	19.4	14.5	16.6
05/06/1999	16.8	12.8	14.7	09/06/1999	22.2	16.68	19.22542	05/06/2000	15.57	13.23	14.19104	09/06/2000	19.6	14.1	16.8
05/07/1999	16.1	11.1	13.5	09/07/1999	21.87	16.04	18.90479	05/07/2000	16.2	12.29	13.87188	09/07/2000	20.9	14.9	17.7
05/08/1999	15.2	11.1	12.9	09/08/1999	22.2	16.2	19.10146	05/08/2000	17.95	12.92	15.14958	09/08/2000	20.9	15.7	18.2
05/09/1999	15.1	10.3	12.6	09/09/1999	21.03	16.99	18.96938	05/09/2000	18.43	14.46	16.00708	09/09/2000	20.9	14.6	17.6
05/10/1999	13.6	11.5	12.6	09/10/1999	21.03	16.52	18.66146	05/10/2000	16.2	12.76	14.19479	09/10/2000	20.9	14.8	17.8
05/11/1999	15.0	12.4	13.4	09/11/1999	21.2	16.04	18.45604	05/11/2000	15.88	11.06	13.33104	09/11/2000	22.5	16.5	19.4
05/12/1999	17.2	12.4	14.3	09/12/1999	21.2	15.88	18.4875	05/12/2000	13.99	10.9	12.67125	09/12/2000	22.9	17.5	20.1
05/13/1999	14.9	11.8	13.1	09/13/1999	21.37	16.04	18.66979	05/13/2000	14.15	11.83	12.82646	09/13/2000	21.5	17.6	19.6
05/14/1999	13.8	11.3	12.4	09/14/1999	21.7	16.04	18.71979	05/14/2000	14.62	11.83	12.87792	09/14/2000	22.4	17.3	19.7
05/15/1999	15.8	10.4	12.7	09/15/1999	20.87	15.88	18.30229	05/15/2000	13.99	11.21	12.6	09/15/2000	22.9	17.9	20.1
05/16/1999	16.8	11.0	13.8	09/16/1999	20.54	16.04	18.29708	05/16/2000	16.52	11.83	13.79729	09/16/2000	22.2	17.8	19.8
05/17/1999	18.9	14.0	16.0	09/17/1999	20.71	15.88	18.26125	05/17/2000	17.63	13.07	15.33	09/17/2000	22.2	16.8	19.5
05/18/1999	19.5	14.1	16.4	09/18/1999	20.87	15.88	18.33583	05/18/2000	19.9	13.84	16.5675	09/18/2000	22.4	17.5	20.0
05/19/1999	19.1	14.1	16.5	09/19/1999	21.03	16.36	18.67583	05/19/2000	22.03	15.57	18.41583	09/19/2000	22.9	18.4	20.5
05/20/1999	19.6	15.6	17.2	09/20/1999	21.03	16.2	18.62354	05/20/2000	22.7	16.04	19.24125	09/20/2000	22.0	18.4	20.2
05/21/1999	18.8	14.2	16.5	09/21/1999	20.71	16.52	18.65417	05/21/2000	24.06	16.68	20.24479	09/21/2000	21.0	17.5	19.2
05/22/1999	19.5	14.6	17.0	09/22/1999	21.03	15.88	18.47604	05/22/2000	24.06	18.27	20.98438	09/22/2000	18.6	15.6	17.2
05/23/1999	21.5	16.1	18.7	09/23/1999	21.03	16.36	18.63875	05/23/2000	25.44	18.27	21.52583	09/23/2000	17.1	13.2	15.3
05/24/1999	23.1	17.6	20.2	09/24/1999	20.54	16.2	18.40646	05/24/2000	24.75	18.92	21.61604	09/24/2000	16.7	11.8	14.3
05/25/1999	22.2	18.2	20.2	09/25/1999	19.9	16.2	17.72208	05/25/2000	23.2	18.11	20.54917	09/25/2000	16.8	11.8	14.3
05/26/1999	22.1	17.2	19.6	09/26/1999	17.79	13.99	15.77917	05/26/2000	23.03	17.47	20.08396	09/26/2000	17.1	12.3	14.7
05/27/1999	23.0	18.3	20.6	09/27/1999	16.68	12.61	14.58146	05/27/2000	21.7	18.11	19.79354	09/27/2000	17.6	12.9	15.2
05/28/1999	22.8	18.6	20.6	09/28/1999	16.36	12.29	14.27229	05/28/2000	22.37	17.15	19.30417	09/28/2000	18.4	14.3	16.3
05/29/1999	20.9	17.5	19.2	09/29/1999	16.83	11.83	14.20646	05/29/2000	22.03	15.57	18.53167	09/29/2000	18.6	14.5	16.5
05/30/1999	20.0	15.7	18.0	09/30/1999	17.31	12.29	14.70458	05/30/2000	20.06	15.57	17.47354	09/30/2000	18.9	14.6	16.7
05/31/1999	21.28	15.9	18.6					05/31/2000	20.54	13.53	16.89083				
			15.7				17.8				16.6				17.7
		9.66				11.83				10.9				11.81667	
	23.08				22.2				25.44				22.86667		

Attachment 3

Temperature Summary

Mouth of the Shasta

May and Sept., 1965-2000

		1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Minimum												
May			16.7		17.0	12.0		12.5	13.5	17.5	14.0	
Sep		16.7		17.8		17.0	15.5	11.0	14.0	16.5	18.5	18.0
Max+min/2												
May			20.8		20.0	18.0		16.8	19.8	22.0	19.0	
Sep		20.5		21.1		20.5	19.0	16.3	20.0	20.0	22.3	21.3
Maximum												
May			25.0		23.0	24.0		21.0	26.0	26.5	24.0	
Sep		24.4		24.4		24.0	22.5	21.5	26.0	23.5	26.0	24.5

Attachment 3

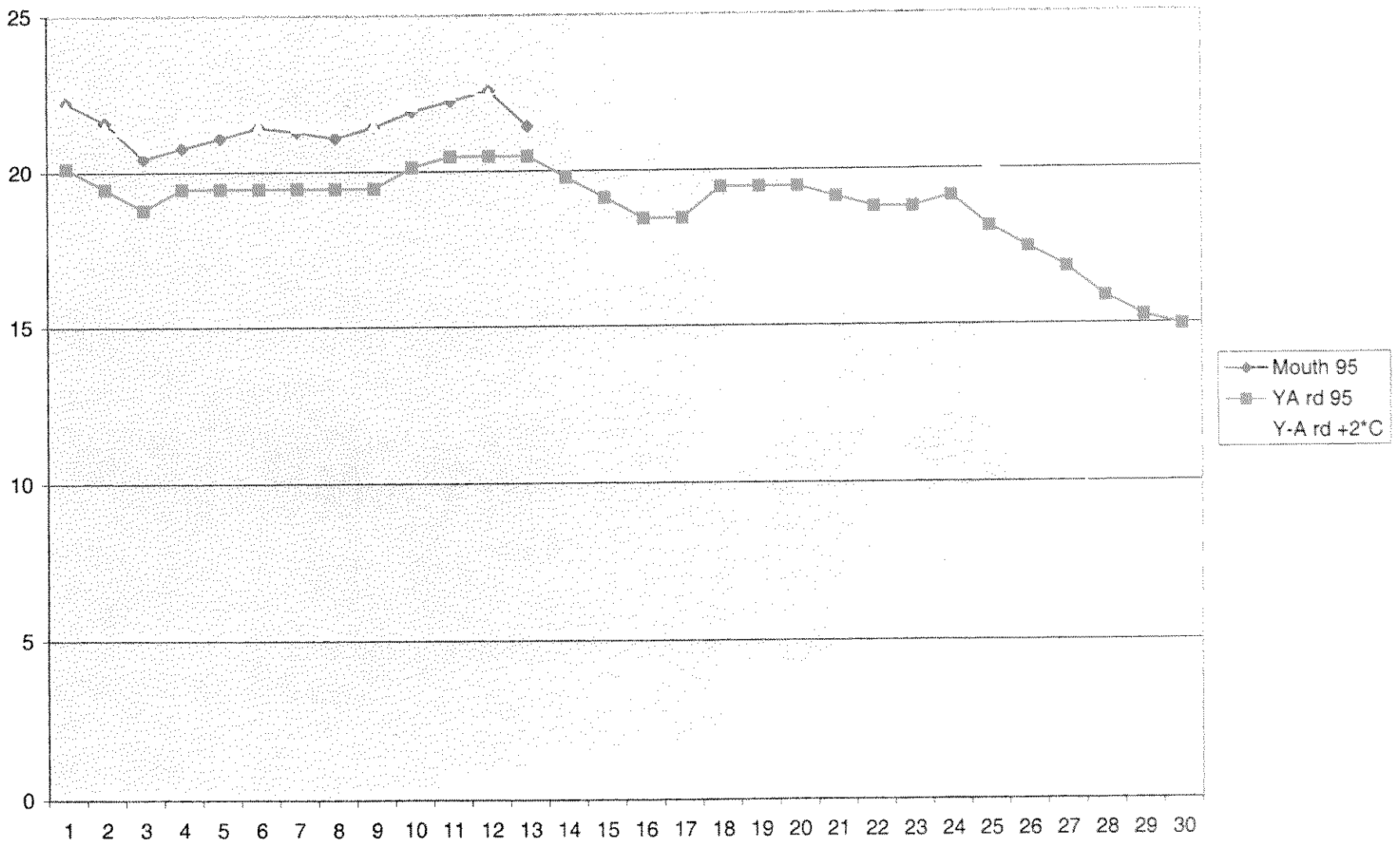
Temperature Summary

Mouth of the Shasta

May and Sept., 1965-2000

1976	**1977**	**1978**			**1994**	**1995**	**1996**	**1997**	**1998**	**1999.0**	**2000**	
												Minimum
17.5	14.5	16.2			11.7		11.7	16.1	11.0	9.7	10.9	May
19.5	15.8				12.9	15.5	12.3	12.9	13.7	11.8	11.8	Sep
												Max+min/2
21.0	19.8	19.8			18.1		16.1	20.9	15.3	16.4	18.2	May
23.0	21.2				17.2	19.0	18.3	18.1	19.8	17.0	17.3	Sep
												Maximum
24.5	25.0	23.5			24.5		20.5	25.8	19.6	23.1	25.4	May
26.5	26.6				21.5	22.6	24.2	23.2	25.8	22.2	22.9	Sep
												Mean
					17.6		15.7	18.7	13.9	15.7	16.6	May
					17.4	18.9	17.1	17.5	18.7	17.8	17.7	Sept

Sept 95 comparisons mouth and YA Rd



Mouth of Shasta, May and September Data

	Celsius		
Date	Maximum	Minimum	Mean
05/01/1994	16.2	11.98	14.45333
05/02/1994	17.81	11.68	14.76267
05/03/1994	16.53	13.76	15.31667
05/04/1994	15.89	13.76	14.986
05/05/1994	17.16	13.15	15.27533
05/06/1994	17.16	14.65	15.83533
05/07/1994	19.13	14.35	16.57467
05/08/1994	21.21	15.89	18.352
05/09/1994	22.82	17.48	19.87133
05/10/1994	23.72	17.81	20.614
05/11/1994	23.35	18.47	20.82733
05/12/1994	22.27	17.16	19.77467
05/13/1994	21.54	15.89	18.722
05/14/1994	20.5	16.2	18.11467
05/15/1994	17.81	14.35	16.194
05/16/1994	16.82	13.46	14.91
05/17/1994	16.82	11.98	14.13333
05/18/1994	17.16	12.28	14.868
05/19/1994	17.81	13.76	15.65867
05/20/1994	18.47	14.04	16.21067
05/21/1994	17.16	14.96	16.208
05/22/1994	20.15	13.46	16.544
05/23/1994	21.9	15.57	18.612
05/24/1994	24.13	17.48	20.56333
05/25/1994	24.51	19.13	21.63067
05/26/1994	21.21	18.8	20.11733
05/27/1994	21.9	16.2	18.95267
05/28/1994	21.54	16.53	18.94333
05/29/1994	21.54	16.53	18.986
05/30/1994	23.01	15.89	19.43467
05/31/1994	22.27	19.13	20.48333
Mean			17.6
Min		11.68	
Max	24.51		

	Celsius		
Date	Maximum	Minimum	Mean
09/07/1994	21.54	18.8	20.43909
09/08/1994	21.21	16.82	18.9495
09/09/1994	18.8	15.57	17.3625
09/10/1994	18.15	14.96	16.5475
09/11/1994	17.16	14.96	15.863
09/12/1994	17.48	13.15	15.4275
09/13/1994	17.81	12.85	15.4775
09/14/1994	18.15	13.46	15.905
09/15/1994	18.8	14.04	16.631
09/16/1994	19.79	14.35	17.081
09/17/1994	19.13	14.96	17.281
09/18/1994	20.15	14.96	17.626
09/19/1994	20.5	15.57	17.9645
09/20/1994	20.15	16.2	18.1225
09/21/1994	20.5	16.2	18.2235
09/22/1994	20.15	16.53	18.1315
09/23/1994	19.46	15.89	17.6945
09/24/1994	18.8	15.89	17.59
09/25/1994	19.46	16.2	18.1985
09/26/1994	20.15	15.89	18.0745
09/27/1994	18.8	15.89	17.7555
09/28/1994	18.8	16.82	17.829
09/29/1994	17.48	15.57	16.683
09/30/1994	17.16	14.35	16.0545
Mean			17.4
Min		12.85	
Max	21.54		

	Celsius		
Date	Maximum	Minimum	Mean
09/01/1995	22.27	16.91	19.4965
09/02/1995	21.61	16.26	18.9805
09/03/1995	20.45	15.46	18.108
09/04/1995	20.78	15.63	18.101
09/05/1995	21.1	15.46	18.3025
09/06/1995	21.44	15.94	18.769
09/07/1995	21.29	16.4	18.817
09/08/1995	21.1	15.94	18.5955
09/09/1995	21.44	16.26	18.9025
09/10/1995	21.94	16.71	19.293
09/11/1995	22.27	16.91	19.59
09/12/1995	22.59	17.04	19.8435
09/13/1995	21.44	17.35	19.05308
09/14/1995			
09/15/1995			
09/16/1995			
09/17/1995			
09/18/1995			
09/19/1995			
09/20/1995			
09/21/1995			
09/22/1995			
09/23/1995			
09/24/1995			
09/25/1995			
09/26/1995			
09/27/1995			
09/28/1995			
09/29/1995			
09/30/1995			
Mean			18.9
Min		15.46	
Max	22.59		

	Celsius		
Date	Maximum	Minimum	Mean
09/01/1996	24.23	18.12	21.05667
09/02/1996	24.23	18.12	20.93771
09/03/1996	23.03	17.63	20.34688
09/04/1996	21.04	16.68	18.69906
09/05/1996	20.22	14.78	17.46719
09/06/1996	20.54	14.16	17.29844
09/07/1996	21.04	14.63	17.92365
09/08/1996	22.2	16.05	19.12677
09/09/1996	23.2	16.84	20.02635
09/10/1996	23.37	17.32	20.23823
09/11/1996	20.87	16.68	18.80979
09/12/1996	18.76	15.89	17.355
09/13/1996	17.16	15.42	16.44604
09/14/1996	17.63	14.16	15.81177
09/15/1996	18.12	15.89	16.62229
09/16/1996	16.84	14.47	15.57854
09/17/1996	16.21	13.69	14.80583
09/18/1996	16.84	12.3	14.53854
09/19/1996	18.6	14.47	16.2726
09/20/1996	18.6	14.31	16.51271
09/21/1996	18.93	15.26	16.88052
09/22/1996	17	13.23	15.07563
09/23/1996	16.68	12.3	14.35927
09/24/1996	17.16	12.61	14.6901
09/25/1996	17.32	13.23	15.11125
09/26/1996	17.47	13.54	15.40229
09/27/1996	18.28	13.69	15.84448
09/28/1996	18.6	14	16.12708
09/29/1996	18.93	14.47	16.61167
09/30/1996	18.44	15.42	16.73823
Mean			17.1
Min		12.3	
Max	24.23		

May and Sept. Mouth of Shasta Data Summary 1994-2000

Date	Celsius Maximu	Minimum	Mean
05/01/1997	16.7	11.4	13.8
05/02/1997	16.7	11.9	13.9
05/03/1997	18.3	13.3	15.2
05/04/1997	17.8	12.2	14.9
05/05/1997	19.4	13.6	16.1
05/06/1997	20.2	14.3	16.8
05/07/1997	21.1	14.3	17.3
05/08/1997	21.9	15.3	18.3
05/09/1997	23.1	16.1	19.2
05/10/1997	23.6	16.7	19.9
05/11/1997	25.0	17.7	21.0
05/12/1997	25.1	18.3	21.3
05/13/1997	23.7	18.0	20.8
05/14/1997	22.4	18.5	20.3
05/15/1997	23.7	18.5	20.7
05/16/1997	24.3	18.0	20.9
05/17/1997	25.3	18.0	21.5
05/18/1997	25.8	18.3	21.8
05/19/1997	25.1	18.1	21.3
05/20/1997	24.1	17.5	20.4
05/21/1997	23.1	15.8	19.3
05/22/1997	19.3	16.1	17.7
05/23/1997	19.3	15.8	17.3
05/24/1997	20.6	14.6	17.1
05/25/1997	21.1	13.4	17.0
05/26/1997	19.3	15.4	17.1
05/27/1997	20.6	16.1	18.2
05/28/1997	20.2	17.5	18.7
05/29/1997	23.2	16.7	19.8
05/30/1997	25.5	18.1	21.6
05/31/1997	22.9	18.8	20.8
			18.7
		11.38	
	25.82		

Date	Celsius Maximu	Minimum	Mean
09/01/1997	23.1	18.0	20.4
09/02/1997	23.2	17.7	20.1
09/03/1997	22.4	17.2	19.7
09/04/1997	23.2	17.7	20.3
09/05/1997	23.2	17.7	20.2
09/06/1997	23.1	17.3	20.0
09/07/1997	22.9	16.9	19.7
09/08/1997	21.7	16.5	19.0
09/09/1997	20.4	17.0	18.9
09/10/1997	22.1	16.9	19.1
09/11/1997	20.9	17.3	19.0
09/12/1997	21.7	16.7	19.0
09/13/1997	20.4	16.4	18.5
09/14/1997	18.1	15.9	17.0
09/15/1997	16.2	14.6	15.4
09/16/1997	17.8	13.9	15.7
09/17/1997	17.8	15.0	16.1
09/18/1997	17.3	13.1	15.0
09/19/1997	17.8	12.9	15.1
09/20/1997	18.5	13.3	15.6
09/21/1997	19.0	13.4	16.0
09/22/1997	19.4	14.0	16.7
09/23/1997	19.6	14.3	16.9
09/24/1997	19.8	14.6	17.0
09/25/1997	19.3	15.0	17.0
09/26/1997	19.0	15.4	16.9
09/27/1997	17.5	13.1	15.3
09/28/1997	18.0	13.3	15.5
09/29/1997	18.5	13.4	15.8
09/30/1997	17.2	14.3	15.7
			17.5
		12.94	
	23.23		

Date	Celsius Maximum	Minimum	Mean
05/01/1998			
05/02/1998			
05/03/1998			
05/04/1998			
05/05/1998			
05/06/1998			
05/07/1998			
05/08/1998			
05/09/1998			
05/10/1998			
05/11/1998			
05/12/1998			
05/13/1998			
05/14/1998			
05/15/1998			
05/16/1998			
05/17/1998			
05/18/1998			
05/19/1998			
05/20/1998	12.28	11.04	12.00143
05/21/1998	14.76	11.34	12.79375
05/22/1998	16.98	12.74	14.88458
05/23/1998	17.46	15.4	16.46875
05/24/1998	16.82	14.44	15.50417
05/25/1998	14.13	12.28	13.2725
05/26/1998	13.21	11.66	12.39417
05/27/1998	13.98	11.34	12.55292
05/28/1998	13.98	12.74	13.34375
05/29/1998	12.9	11.19	12.14708
05/30/1998	17.14	12.43	14.53833
05/31/1998	19.57	15.08	17.28125
			13.9
		11.04	
	19.57		

Date	Celsius Maximu	Minimum	Mean
09/01/1998	25.3	19.3	22.3
09/02/1998	25.7	19.8	22.7
09/03/1998	25.8	20.2	23.0
09/04/1998	25.8	20.7	23.3
09/05/1998	24.6	21.2	22.9
09/06/1998	23.7	19.6	21.7
09/07/1998	22.9	20.7	21.9
09/08/1998	22.1	19.0	20.6
09/09/1998	20.2	17.7	18.9
09/10/1998	20.9	15.9	18.2
09/11/1998	21.2	15.8	18.4
09/12/1998	21.9	16.5	19.1
09/13/1998	22.4	17.0	19.6
09/14/1998	22.7	17.2	19.9
09/15/1998	22.9	17.7	20.2
09/16/1998	22.2	17.5	19.8
09/17/1998	20.9	16.9	18.6
09/18/1998	18.6	15.8	17.0
09/19/1998	18.3	14.2	16.2
09/20/1998	18.6	13.7	16.1
09/21/1998	19.0	14.0	16.3
09/22/1998	18.6	13.7	16.1
09/23/1998	18.6	13.7	16.2
09/24/1998	18.6	14.0	16.3
09/25/1998	18.0	15.4	16.6
09/26/1998	17.0	13.9	15.5
09/27/1998	18.1	14.0	15.8
09/28/1998	17.7	14.5	15.8
09/29/1998	18.3	14.5	16.1
09/30/1998	18.5	14.6	16.3
			18.7
		13.71	
	25.82		

May and Sept. Mouth of Shasta Data Summary 1994-2000

NBS data from Sharon Campbell

	Celsius		
Date	Maximum	Minimum	Mean
05/01/1999 0:00	17.2	13.4	15.0
05/02/1999 0:00	14.5	12.1	12.9
05/03/1999 0:00	13.8	10.6	12.0
05/04/1999 3:00	14.3	9.7	11.6
05/05/1999 0:00	16.3	10.2	13.1
05/06/1999 0:00	16.8	12.8	14.7
05/07/1999 0:00	16.1	11.1	13.5
05/08/1999 1:00	15.2	11.1	12.9
05/09/1999 0:00	15.1	10.3	12.6
05/10/1999 0:00	13.6	11.5	12.6
05/11/1999 0:00	15.0	12.4	13.4
05/12/1999 0:00	17.2	12.4	14.3
05/13/1999 0:00	14.9	11.8	13.1
05/14/1999 0:00	13.8	11.3	12.4
05/15/1999 0:00	15.8	10.4	12.7
05/16/1999 0:00	16.8	11.0	13.8
05/17/1999 0:00	18.9	14.0	16.0
05/18/1999 0:00	19.5	14.1	16.4
05/19/1999 0:00	19.1	14.1	16.5
05/20/1999 0:00	19.6	15.6	17.2
05/21/1999 0:00	18.8	14.2	16.5
05/22/1999 0:00	19.5	14.6	17.0
05/23/1999 0:00	21.5	16.1	18.7
05/24/1999 0:00	23.1	17.6	20.2
05/25/1999 0:00	22.2	18.2	20.2
05/26/1999 0:00	22.1	17.2	19.6
05/27/1999 0:00	23.0	18.3	20.6
05/28/1999 0:00	22.8	18.6	20.6
05/29/1999 0:00	20.9	17.5	19.2
05/30/1999 0:00	20.0	15.7	18.0
05/31/1999 0:00	21.28	15.9	18.6
			15.7
		9.66	
	23.08		

	Celsius		
Date	Maximum	Minimum	Mean
09/01/1999	19.9	13.53	16.68688
09/02/1999	20.54	14.46	17.33646
09/03/1999	20.71	14.77	17.62313
09/04/1999	21.03	14.62	17.79292
09/05/1999	21.87	15.57	18.6975
09/06/1999	22.2	16.68	19.22542
09/07/1999	21.87	16.04	18.90479
09/08/1999	22.2	16.2	19.10146
09/09/1999	21.03	16.99	18.96938
09/10/1999	21.03	16.52	18.66146
09/11/1999	21.2	16.04	18.45604
09/12/1999	21.2	15.88	18.4875
09/13/1999	21.37	16.04	18.66979
09/14/1999	21.7	16.04	18.71979
09/15/1999	20.87	15.88	18.30229
09/16/1999	20.54	16.04	18.29708
09/17/1999	20.71	15.88	18.26125
09/18/1999	20.87	15.88	18.33583
09/19/1999	21.03	16.36	18.67583
09/20/1999	21.03	16.2	18.62354
09/21/1999	20.71	16.52	18.65417
09/22/1999	21.03	15.88	18.47604
09/23/1999	21.03	16.36	18.63875
09/24/1999	20.54	16.2	18.40646
09/25/1999	19.9	16.2	17.72208
09/26/1999	17.79	13.99	15.77917
09/27/1999	16.68	12.61	14.58146
09/28/1999	16.36	12.29	14.27229
09/29/1999	16.83	11.83	14.20646
09/30/1999	17.31	12.29	14.70458
			17.8
		11.83	
	22.2		

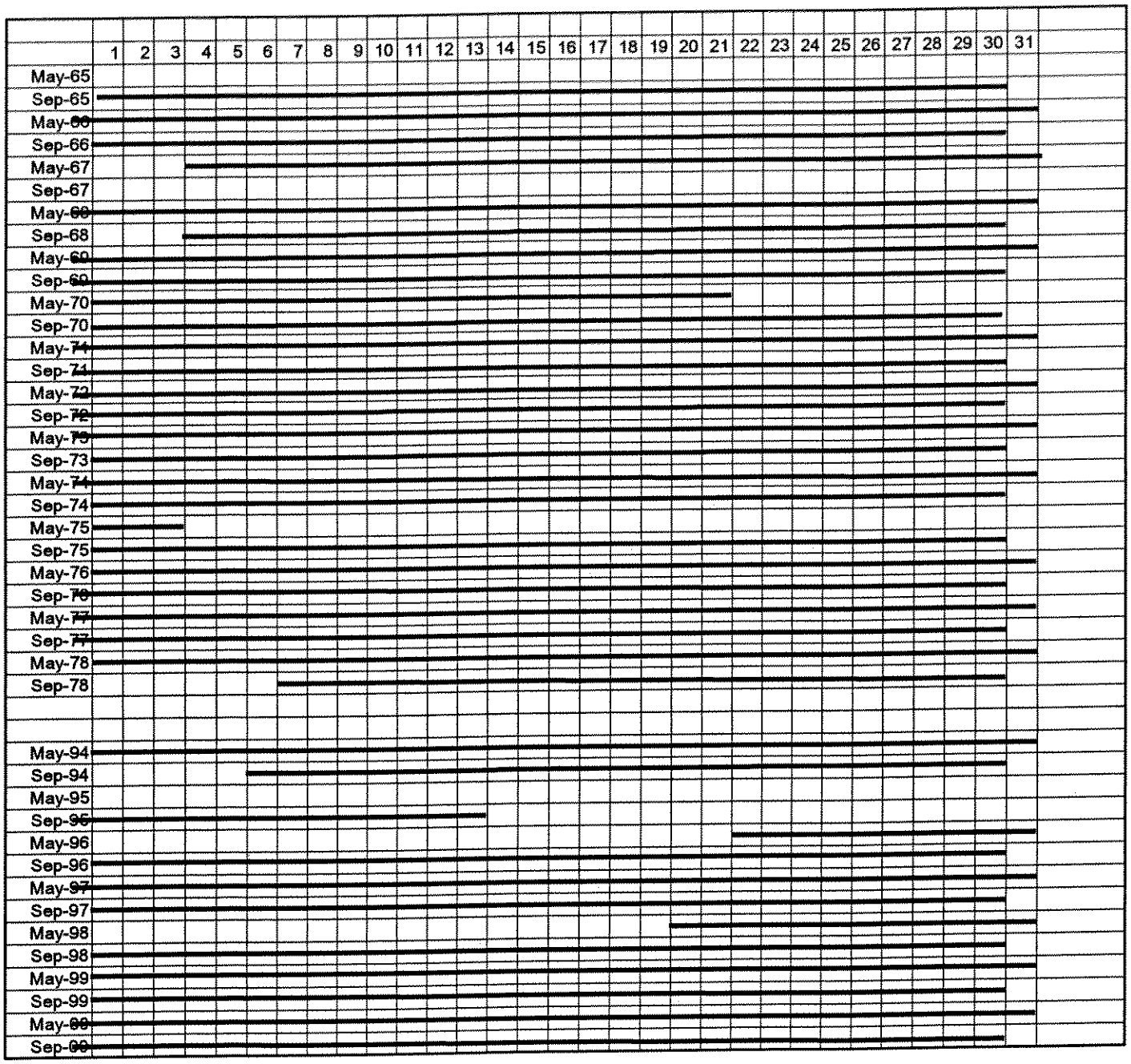
	Celsius		
Date	Maximum	Minimum	Mean
05/01/2000	16.83	13.84	15.21583
05/02/2000	18.11	13.07	15.29667
05/03/2000	18.27	14.46	15.9175
05/04/2000	17.63	13.84	15.45063
05/05/2000	17.31	12.76	14.96063
05/06/2000	15.57	13.23	14.19104
05/07/2000	16.2	12.29	13.87188
05/08/2000	17.95	12.92	15.14958
05/09/2000	18.43	14.46	16.00708
05/10/2000	16.2	12.76	14.19479
05/11/2000	15.88	11.06	13.33104
05/12/2000	13.99	10.9	12.67125
05/13/2000	14.15	11.83	12.82646
05/14/2000	14.62	11.83	12.87792
05/15/2000	13.99	11.21	12.6
05/16/2000	16.52	11.83	13.79729
05/17/2000	17.63	13.07	15.33
05/18/2000	19.9	13.84	16.5675
05/19/2000	22.03	15.57	18.41583
05/20/2000	22.7	16.04	19.24125
05/21/2000	24.06	16.68	20.24479
05/22/2000	24.06	18.27	20.98438
05/23/2000	25.44	18.27	21.52583
05/24/2000	24.75	18.92	21.61604
05/25/2000	23.2	18.11	20.54917
05/26/2000	23.03	17.47	20.08396
05/27/2000	21.7	18.11	19.79354
05/28/2000	22.37	17.15	19.30417
05/29/2000	22.03	15.57	18.53167
05/30/2000	20.06	15.57	17.47354
05/31/2000	20.54	13.53	16.89083
			16.6
		10.9	
	25.44		

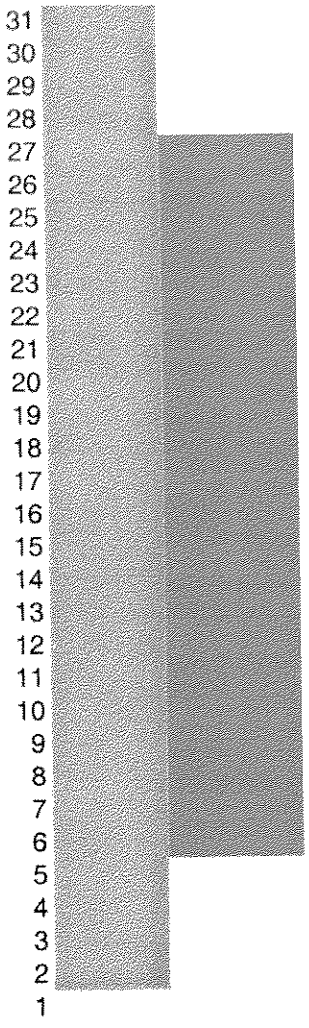
	Celsius		
Date	Maximum	Minimum	Mean
09/01/2000	19.9	17.0	18.2
09/02/2000	17.8	14.9	16.2
09/03/2000	18.9	14.1	16.5
09/04/2000	17.9	14.8	16.3
09/05/2000	19.4	14.5	16.6
09/06/2000	19.6	14.1	16.8
09/07/2000	20.9	14.9	17.7
09/08/2000	20.9	15.7	18.2
09/09/2000	20.9	14.6	17.6
09/10/2000	20.9	14.8	17.8
09/11/2000	22.5	16.5	19.4
09/12/2000	22.9	17.5	20.1
09/13/2000	21.5	17.6	19.6
09/14/2000	22.4	17.3	19.7
09/15/2000	22.9	17.9	20.1
09/16/2000	22.2	17.8	19.8
09/17/2000	22.2	16.8	19.5
09/18/2000	22.4	17.5	20.0
09/19/2000	22.9	18.4	20.5
09/20/2000	22.0	18.4	20.2
09/21/2000	21.0	17.5	19.2
09/22/2000	18.6	15.6	17.2
09/23/2000	17.1	13.2	15.3
09/24/2000	16.7	11.8	14.3
09/25/2000	16.8	11.8	14.3
09/26/2000	17.1	12.3	14.7
09/27/2000	17.6	12.9	15.2
09/28/2000	18.4	14.3	16.3
09/29/2000	18.6	14.5	16.5
09/30/2000	18.9	14.6	16.7
			17.7
		11.81667	
	22.86667		

Temperature Data Availability

Attachment 4

Mouth of Shasta




31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
May-65
Sep-65

Monthly Flow Data,
Mouth of Shasta May and September

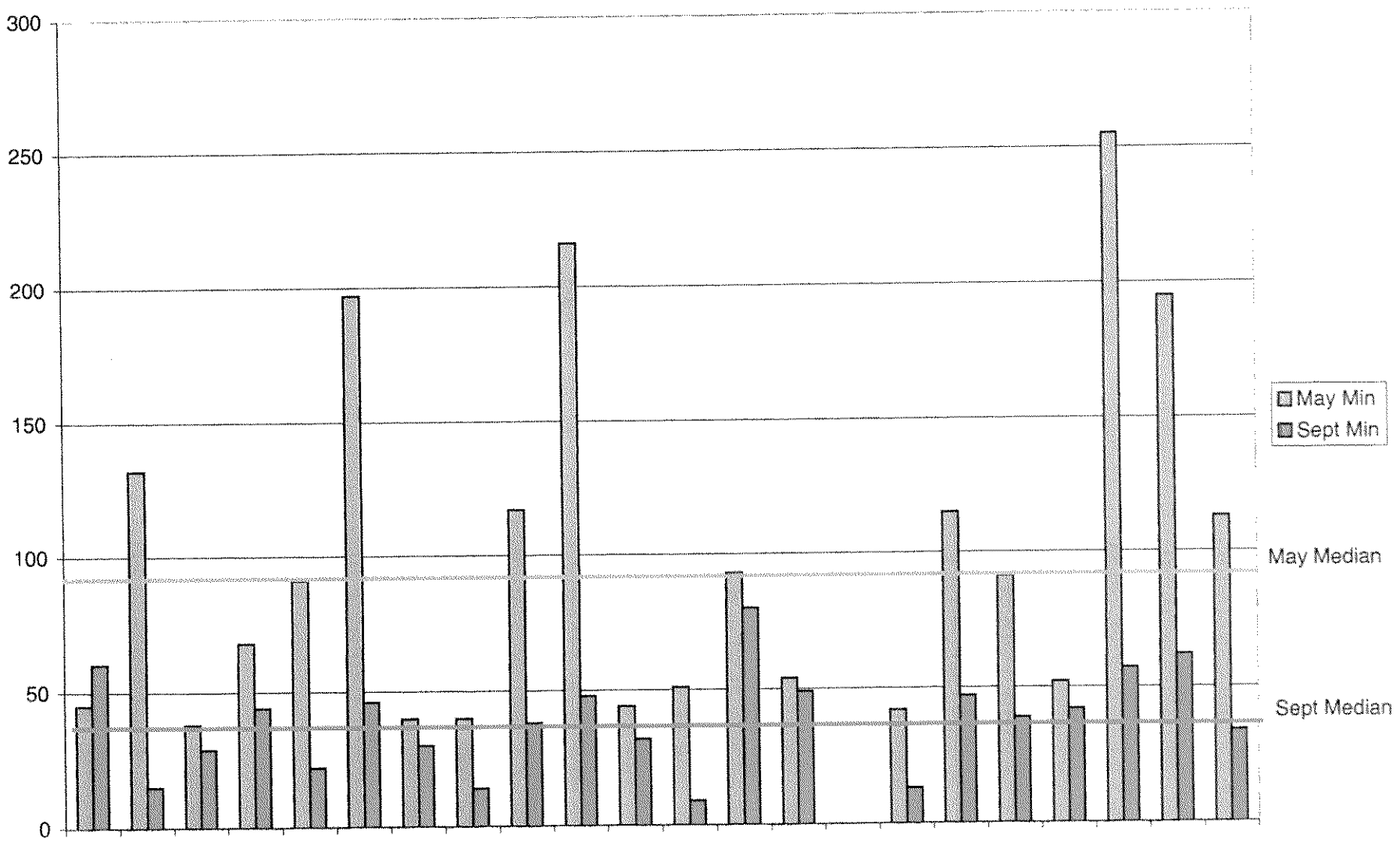
Attachment 5

	Max	Min	Mean
Sep-65	136	60	92
May-66	92	45	66
Sep-66	127	15	62
May-67	471	132	231
May-68	103	38	64
Sep-68	99	29	57
May-69	195	68	123
Sep-69	129	44	81
May-70	206	91	135
Sep-70	115	22	59
May-71	591	197	359
Sep-71	172	46	85
May-72	302	40	106
Sep-72	183	30	81
May-73	110	40	65
Sep-73	125	14	55
May-74	312	117	214
Sep-74	116	38	72
May-75	440	216	297
Sep-75	116	48	75
May-76	144	44	87
Sep-76	125	32	73
May-77	148	51	85
Sep-77	129	9	31
May-78	203	93	133
Sep-78	453	80	182
May-79	282	54	134
Sep-79	119	49	71
May-94	194	42	78
Sep-94	66	13	30
May-95	445	115	261
Sep-95	87	47	63
May-96	275	91	168
Sep-96	117	39	78
May-97	171	52	105
Sep-97	140	42	86
May-98	1090	255	678
Sep-98	153	57	101
May-99	285	195	227
Sep-99	114	62	79
May-00	184	113	149
Sep-00	102	34	65

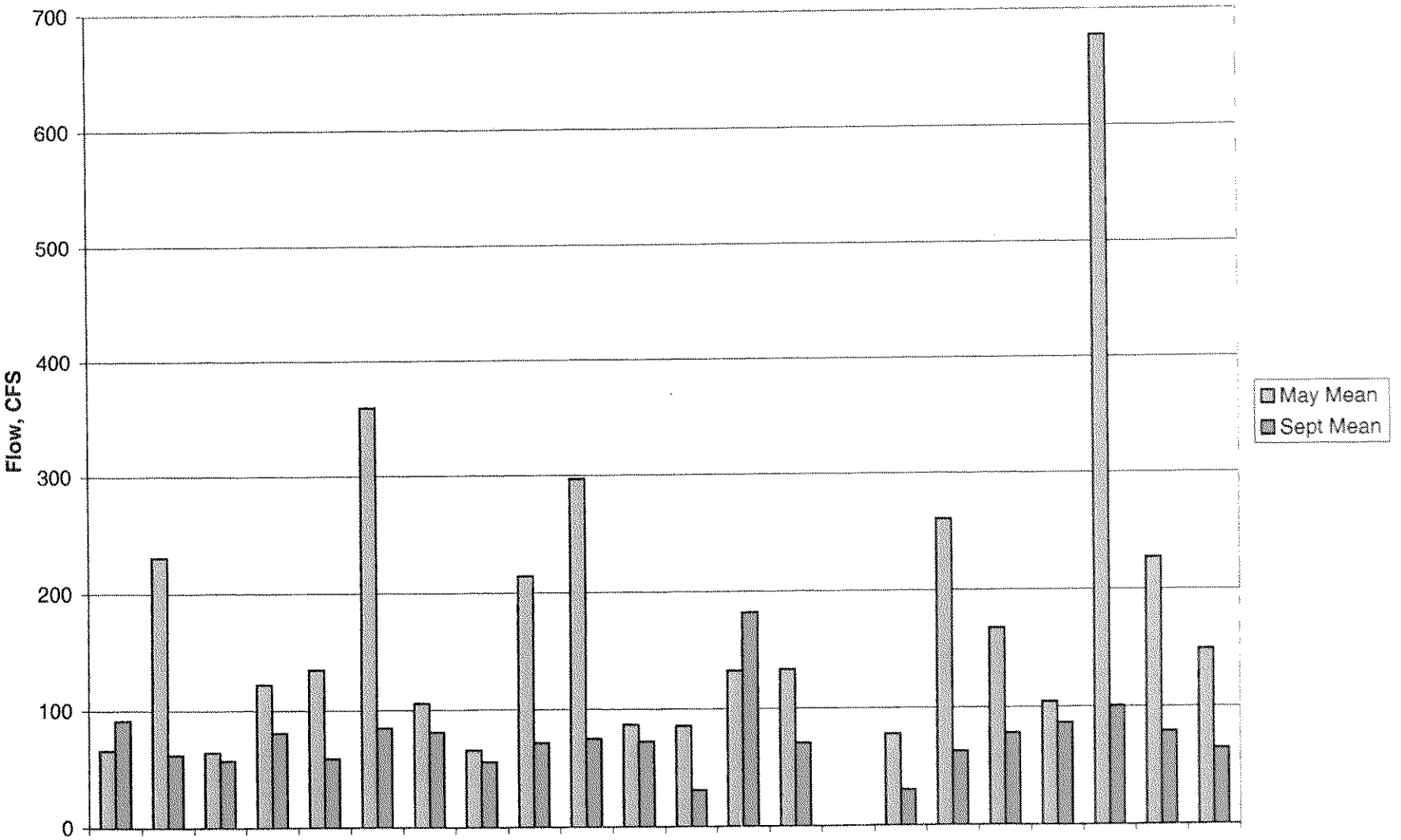
	Max	Min	Mean
May-66	92	45	66
May-67	471	132	231
May-68	103	38	64
May-69	195	68	123
May-70	206	91	135
May-71	591	197	359
May-72	302	40	106
May-73	110	40	65
May-74	312	117	214
May-75	440	216	297
May-76	144	44	87
May-77	148	51	85
May-78	203	93	133
May-79	282	54	134
May-94	194	42	78
May-95	445	115	261
May-96	275	91	168
May-97	171	52	105
May-98	1090	255	678
May-99	285	195	227
May-00	184	113	149
Average	297	99	179
median		91	

	Max	Min	Mean
Sep-65	136	60	92
Sep-66	127	15	62
Sep-68	99	29	57
Sep-69	129	44	81
Sep-70	115	22	59
Sep-71	172	46	85
Sep-72	183	30	81
Sep-73	125	14	55
Sep-74	116	38	72
Sep-75	116	48	75
Sep-76	125	32	73
Sep-77	129	9	31
Sep-78	453	80	182
Sep-79	119	49	71
Sep-94	66	13	30
Sep-95	87	47	63
Sep-96	117	39	78
Sep-97	140	42	86
Sep-98	153	57	101
Sep-99	114	62	79
Sep-00	102	34	65
average	139	39	75
median		39	

Minimum flows, May and September, Shasta River



Mean Flows, May and Sept



2000 data preliminary

09/01/1965	84	05/01/1966	71	09/01/1966	18
09/02/1965	94	05/02/1966	72	09/02/1966	16
09/03/1965	111	05/03/1966	68	09/03/1966	24
09/04/1965	93	05/04/1966	66	09/04/1966	23
09/05/1965	90	05/05/1966	73	09/05/1966	18
09/06/1965	90	05/06/1966	67	09/06/1966	16
09/07/1965	101	05/07/1966	73	09/07/1966	16
09/08/1965	113	05/08/1966	80	09/08/1966	15
09/09/1965	105	05/09/1966	83	09/09/1966	15
09/10/1965	76	05/10/1966	75	09/10/1966	18
09/11/1965	70	05/11/1966	68	09/11/1966	24
09/12/1965	76	05/12/1966	66	09/12/1966	36
09/13/1965	74	05/13/1966	66	09/13/1966	42
09/14/1965	65	05/14/1966	71	09/14/1966	48
09/15/1965	61	05/15/1966	77	09/15/1966	45
09/16/1965	60	05/16/1966	74	09/16/1966	44
09/17/1965	66	05/17/1966	70	09/17/1966	45
09/18/1965	70	05/18/1966	71	09/18/1966	65
09/19/1965	89	05/19/1966	63	09/19/1966	114
09/20/1965	102	05/20/1966	59	09/20/1966	109
09/21/1965	109	05/21/1966	53	09/21/1966	120
09/22/1965	95	05/22/1966	51	09/22/1966	127
09/23/1965	99	05/23/1966	55	09/23/1966	122
09/24/1965	96	05/24/1966	45	09/24/1966	120
09/25/1965	104	05/25/1966	45	09/25/1966	120
09/26/1965	110	05/26/1966	46	09/26/1966	124
09/27/1965	106	05/27/1966	46	09/27/1966	124
09/28/1965	99	05/28/1966	57	09/28/1966	120
09/29/1965	102	05/29/1966	63	09/29/1966	83
09/30/1965	136	05/30/1966	77	09/30/1966	54
		05/31/1966	92		

Sep-65		May-66		Sep-66	
Max	136	Max	92	Max	127
Min	60	Min	45	Min	15
Mean	92	Mean	66	Mean	62

	Sep-65		May-66		Sep-66
Max	136	Max	92	Max	127
Min	60	Min	45	Min	15
Mean	91.5	Mean	65.9	Mean	62.2

Sep-65	136	60	91.5
May-66	92	45	65.9
Sep-66	127	15	62.2

May-67	471	132	230.7
May-68	103	38	64.3
Sep-68	99	29	57.4
May-69	195	68	122.6
Sep-69	129	44	80.7
May-70	206	91	135.3
Sep-70	115	22	59.1
May-71	591	197	359.0
Sep-71	172	46	84.8
May-72	302	40	105.6
Sep-72	183	30	80.9
May-73	110	40	65.4
Sep-73	125	14	55.4
May-74	312	117	213.9
Sep-74	116	38	71.7
May-75	440	216	297.1
Sep-75	116	48	75.2
May-76	144	44	86.8
Sep-76	125	32	72.7
May-77	148	51	85.5
Sep-77	129	9	30.9
May-78	203	93	132.8
Sep-78	453	80	182.3
May-79	282	54	133.5
Sep-79	119	49	70.6
May-94	194	42	78.2
Sep-94	66	13	30.0
May-95	445	115	261.1
Sep-95	87	47	62.9
May-96	275	91	167.8
Sep-96	117	39	78.0
May-97	171	52	104.6
Sep-97	140	42	86.4
May-98	1090	255	677.5
Sep-98	153	57	100.7
May-99	285	195	227.1
Sep-99	114	62	79.2
May-00	184	113	149.4
Sep-00	102	34	64.7

05/01/1967	196
05/02/1967	187
05/03/1967	196
05/04/1967	164
05/05/1967	151
05/06/1967	146
05/07/1967	153
05/08/1967	181
05/09/1967	336
05/10/1967	455
05/11/1967	440
05/12/1967	471
05/13/1967	391
05/14/1967	290
05/15/1967	240
05/16/1967	247
05/17/1967	223
05/18/1967	240
05/19/1967	238
05/20/1967	245
05/21/1967	240
05/22/1967	242
05/23/1967	218
05/24/1967	198
05/25/1967	176
05/26/1967	154
05/27/1967	132
05/28/1967	149
05/29/1967	152
05/30/1967	152
05/31/1967	150
May-67	
Max	471
Min	132
Mean	231

05/01/1968	64
05/02/1968	53
05/03/1968	45
05/04/1968	45
05/05/1968	38
05/06/1968	43
05/07/1968	58
05/08/1968	61
05/09/1968	53
05/10/1968	45
05/11/1968	46
05/12/1968	53
05/13/1968	56
05/14/1968	53
05/15/1968	58
05/16/1968	53
05/17/1968	55
05/18/1968	58
05/19/1968	53
05/20/1968	62
05/21/1968	64
05/22/1968	101
05/23/1968	103
05/24/1968	97
05/25/1968	99
05/26/1968	95
05/27/1968	97
05/28/1968	99
05/29/1968	80
05/30/1968	59
05/31/1968	46
May-68	
Max	103
Min	38
Mean	64

09/01/1968	61
09/02/1968	61
09/03/1968	55
09/04/1968	39
09/05/1968	30
09/06/1968	37
09/07/1968	42
09/08/1968	42
09/09/1968	39
09/10/1968	34
09/11/1968	58
09/12/1968	67
09/13/1968	48
09/14/1968	34
09/15/1968	29
09/16/1968	41
09/17/1968	39
09/18/1968	41
09/19/1968	37
09/20/1968	49
09/21/1968	68
09/22/1968	68
09/23/1968	76
09/24/1968	73
09/25/1968	85
09/26/1968	87
09/27/1968	87
09/28/1968	99
09/29/1968	99
09/30/1968	97
Sep-68	
Max	99
Min	29
Mean	57

	May-67
Max	471
Min	132
Mean	230.7

	May-68
Max	103
Min	38
Mean	64.3

	Sep-68
Max	99
Min	29
Mean	57.4

05/01/1969	171
05/02/1969	164
05/03/1969	148
05/04/1969	130
05/05/1969	125
05/06/1969	122
05/07/1969	106
05/08/1969	105
05/09/1969	97
05/10/1969	97
05/11/1969	117
05/12/1969	127
05/13/1969	195
05/14/1969	159
05/15/1969	157
05/16/1969	134
05/17/1969	122
05/18/1969	117
05/19/1969	122
05/20/1969	129
05/21/1969	133
05/22/1969	112
05/23/1969	104
05/24/1969	106
05/25/1969	118
05/26/1969	130
05/27/1969	133
05/28/1969	104
05/29/1969	74
05/30/1969	68
05/31/1969	74
May-69	
Max	195
Min	68
Mean	123

	May-69
Max	195
Min	68
Mean	122.6

09/01/1969	66
09/02/1969	80
09/03/1969	73
09/04/1969	68
09/05/1969	74
09/06/1969	71
09/07/1969	72
09/08/1969	76
09/09/1969	66
09/10/1969	56
09/11/1969	44
09/12/1969	45
09/13/1969	49
09/14/1969	58
09/15/1969	55
09/16/1969	49
09/17/1969	54
09/18/1969	74
09/19/1969	72
09/20/1969	81
09/21/1969	105
09/22/1969	111
09/23/1969	117
09/24/1969	127
09/25/1969	129
09/26/1969	111
09/27/1969	93
09/28/1969	104
09/29/1969	124
09/30/1969	116
Sep-69	
Max	129
Min	44
Mean	81
Mean	81

	Sep-69
Max	129
Min	44
Mean	80.7

05/01/1970	177
05/02/1970	191
05/03/1970	173
05/04/1970	156
05/05/1970	112
05/06/1970	115
05/07/1970	126
05/08/1970	136
05/09/1970	132
05/10/1970	140
05/11/1970	195
05/12/1970	206
05/13/1970	203
05/14/1970	181
05/15/1970	155
05/16/1970	133
05/17/1970	113
05/18/1970	107
05/19/1970	116
05/20/1970	131
05/21/1970	123
05/22/1970	112
05/23/1970	108
05/24/1970	112
05/25/1970	114
05/26/1970	93
05/27/1970	91
05/28/1970	97
05/29/1970	117
05/30/1970	117
05/31/1970	113
May-70	
Max	206
Min	91
Mean	135

	May-70
Max	206
Min	91
Mean	135.3

09/01/1970	24
09/02/1970	22
09/03/1970	43
09/04/1970	36
09/05/1970	78
09/06/1970	64
09/07/1970	70
09/08/1970	69
09/09/1970	43
09/10/1970	36
09/11/1970	33
09/12/1970	34
09/13/1970	30
09/14/1970	28
09/15/1970	55
09/16/1970	48
09/17/1970	45
09/18/1970	50
09/19/1970	56
09/20/1970	62
09/21/1970	56
09/22/1970	69
09/23/1970	78
09/24/1970	70
09/25/1970	64
09/26/1970	78
09/27/1970	95
09/28/1970	112
09/29/1970	111
09/30/1970	115

Sep-70	
Max	115
Min	22
Mean	59

	Sep-70
Max	115
Min	22
Mean	59.1

05/01/1971	248
05/02/1971	261
05/03/1971	432
05/04/1971	588
05/05/1971	591
05/06/1971	527
05/07/1971	439
05/08/1971	486
05/09/1971	537
05/10/1971	520
05/11/1971	437
05/12/1971	376
05/13/1971	382
05/14/1971	354
05/15/1971	329
05/16/1971	329
05/17/1971	322
05/18/1971	300
05/19/1971	255
05/20/1971	215
05/21/1971	208
05/22/1971	209
05/23/1971	202
05/24/1971	197
05/25/1971	204
05/26/1971	406
05/27/1971	426
05/28/1971	384
05/29/1971	351
05/30/1971	307
05/31/1971	308

May-71	
Max	591
Min	197
Mean	359

	May-71
Max	591
Min	197
Mean	359.0

09/01/1971	47
09/02/1971	46
09/03/1971	48
09/04/1971	54
09/05/1971	50
09/06/1971	67
09/07/1971	71
09/08/1971	65
09/09/1971	62
09/10/1971	63
09/11/1971	68
09/12/1971	76
09/13/1971	84
09/14/1971	69
09/15/1971	55
09/16/1971	60
09/17/1971	60
09/18/1971	60
09/19/1971	87
09/20/1971	103
09/21/1971	97
09/22/1971	116
09/23/1971	124
09/24/1971	125
09/25/1971	129
09/26/1971	121
09/27/1971	121
09/28/1971	115
09/29/1971	130
09/30/1971	172

Sep-71	
Max	172
Min	46
Mean	85

	Sep-71
Max	172
Min	46
Mean	84.8

05/01/1972	101
05/02/1972	88
05/03/1972	69
05/04/1972	65
05/05/1972	84
05/06/1972	82
05/07/1972	78
05/08/1972	69
05/09/1972	51
05/10/1972	51
05/11/1972	49
05/12/1972	45
05/13/1972	44
05/14/1972	60
05/15/1972	110
05/16/1972	100
05/17/1972	111
05/18/1972	126
05/19/1972	122
05/20/1972	134
05/21/1972	302
05/22/1972	300
05/23/1972	252
05/24/1972	196
05/25/1972	186
05/26/1972	168
05/27/1972	43
05/28/1972	47
05/29/1972	48
05/30/1972	40
05/31/1972	53
May-72	
Max	302
Min	40
Mean	106

09/01/1972	30
09/02/1972	51
09/03/1972	42
09/04/1972	57
09/05/1972	64
09/06/1972	54
09/07/1972	44
09/08/1972	38
09/09/1972	36
09/10/1972	39
09/11/1972	51
09/12/1972	45
09/13/1972	48
09/14/1972	55
09/15/1972	62
09/16/1972	64
09/17/1972	62
09/18/1972	69
09/19/1972	76
09/20/1972	78
09/21/1972	88
09/22/1972	126
09/23/1972	135
09/24/1972	135
09/25/1972	132
09/26/1972	135
09/27/1972	183
09/28/1972	149
09/29/1972	137
09/30/1972	143
Sep-72	
Max	183
Min	30
Mean	81

05/01/1973	101
05/02/1973	88
05/03/1973	69
05/04/1973	65
05/05/1973	84
05/06/1973	82
05/07/1973	78
05/08/1973	69
05/09/1973	51
05/10/1973	51
05/11/1973	49
05/12/1973	45
05/13/1973	44
05/14/1973	60
05/15/1973	110
05/16/1973	90
05/17/1973	88
05/18/1973	78
05/19/1973	66
05/20/1973	61
05/21/1973	71
05/22/1973	59
05/23/1973	54
05/24/1973	55
05/25/1973	63
05/26/1973	66
05/27/1973	43
05/28/1973	47
05/29/1973	48
05/30/1973	40
05/31/1973	53
May-73	
Max	110
Min	40
Mean	65

	May-72
Max	302
Min	40
Mean	105.6

	Sep-72
Max	183
Min	30
Mean	80.9

	May-73
Max	110
Min	40
Mean	65.4

09/01/1973	14
09/02/1973	14
09/03/1973	21
09/04/1973	23
09/05/1973	22
09/06/1973	21
09/07/1973	23
09/08/1973	24
09/09/1973	23
09/10/1973	26
09/11/1973	30
09/12/1973	31
09/13/1973	29
09/14/1973	25
09/15/1973	25
09/16/1973	20
09/17/1973	19
09/18/1973	22
09/19/1973	28
09/20/1973	110
09/21/1973	125
09/22/1973	110
09/23/1973	109
09/24/1973	122
09/25/1973	120
09/26/1973	100
09/27/1973	90
09/28/1973	109
09/29/1973	109
09/30/1973	118

Sep-73	
Max	125
Min	14
Mean	55

	Sep-73
Max	125
Min	14
Mean	55.4

05/01/1974	312
05/02/1974	299
05/03/1974	293
05/04/1974	276
05/05/1974	267
05/06/1974	269
05/07/1974	271
05/08/1974	259
05/09/1974	252
05/10/1974	263
05/11/1974	278
05/12/1974	268
05/13/1974	249
05/14/1974	238
05/15/1974	206
05/16/1974	217
05/17/1974	225
05/18/1974	225
05/19/1974	187
05/20/1974	188
05/21/1974	174
05/22/1974	148
05/23/1974	141
05/24/1974	131
05/25/1974	122
05/26/1974	117
05/27/1974	137
05/28/1974	159
05/29/1974	172
05/30/1974	148
05/31/1974	141

May-74	
Max	312
Min	117
Mean	214

	May-74
Max	312
Min	117
Mean	213.9

09/01/1974	62
09/02/1974	57
09/03/1974	54
09/04/1974	48
09/05/1974	39
09/06/1974	38
09/07/1974	45
09/08/1974	50
09/09/1974	69
09/10/1974	83
09/11/1974	76
09/12/1974	79
09/13/1974	83
09/14/1974	75
09/15/1974	83
09/16/1974	92
09/17/1974	70
09/18/1974	54
09/19/1974	58
09/20/1974	62
09/21/1974	71
09/22/1974	75
09/23/1974	78
09/24/1974	90
09/25/1974	87
09/26/1974	78
09/27/1974	77
09/28/1974	92
09/29/1974	110
09/30/1974	116

Sep-74	
Max	116
Min	38
Mean	72

	Sep-74
Max	116
Min	38
Mean	71.7

05/01/1975	218
05/02/1975	216
05/03/1975	216
05/04/1975	222
05/05/1975	248
05/06/1975	262
05/07/1975	240
05/08/1975	222
05/09/1975	238
05/10/1975	282
05/11/1975	328
05/12/1975	348
05/13/1975	330
05/14/1975	370
05/15/1975	400
05/16/1975	440
05/17/1975	408
05/18/1975	376
05/19/1975	354
05/20/1975	370
05/21/1975	350
05/22/1975	285
05/23/1975	250
05/24/1975	268
05/25/1975	275
05/26/1975	268
05/27/1975	254
05/28/1975	270
05/29/1975	282
05/30/1975	300
05/31/1975	319
May-75	
Max	440
Min	216
Mean	297

09/01/1975	69
09/02/1975	65
09/03/1975	63
09/04/1975	63
09/05/1975	64
09/06/1975	69
09/07/1975	65
09/08/1975	60
09/09/1975	48
09/10/1975	54
09/11/1975	60
09/12/1975	57
09/13/1975	76
09/14/1975	104
09/15/1975	116
09/16/1975	72
09/17/1975	76
09/18/1975	85
09/19/1975	74
09/20/1975	66
09/21/1975	67
09/22/1975	79
09/23/1975	83
09/24/1975	73
09/25/1975	83
09/26/1975	93
09/27/1975	94
09/28/1975	93
09/29/1975	96
09/30/1975	88
Sep-75	
Max	116
Min	48
Mean	75

05/01/1976	94
05/02/1976	90
05/03/1976	94
05/04/1976	100
05/05/1976	101
05/06/1976	92
05/07/1976	105
05/08/1976	115
05/09/1976	123
05/10/1976	144
05/11/1976	140
05/12/1976	134
05/13/1976	121
05/14/1976	102
05/15/1976	102
05/16/1976	105
05/17/1976	84
05/18/1976	73
05/19/1976	71
05/20/1976	68
05/21/1976	63
05/22/1976	66
05/23/1976	62
05/24/1976	56
05/25/1976	52
05/26/1976	47
05/27/1976	44
05/28/1976	55
05/29/1976	67
05/30/1976	54
05/31/1976	66
May-76	
Max	144
Min	44
Mean	87

	May-75
Max	440
Min	216
Mean	297.1

	Sep-75
Max	116
Min	48
Mean	75.2

	May-76
Max	144
Min	44
Mean	86.8

09/01/1976	67
09/02/1976	49
09/03/1976	49
09/04/1976	47
09/05/1976	37
09/06/1976	36
09/07/1976	42
09/08/1976	43
09/09/1976	33
09/10/1976	32
09/11/1976	39
09/12/1976	53
09/13/1976	60
09/14/1976	69
09/15/1976	64
09/16/1976	83
09/17/1976	99
09/18/1976	105
09/19/1976	95
09/20/1976	86
09/21/1976	85
09/22/1976	70
09/23/1976	86
09/24/1976	82
09/25/1976	116
09/26/1976	125
09/27/1976	107
09/28/1976	107
09/29/1976	103
09/30/1976	111

Sep-76	
Max	125
Min	32
Mean	73

	Sep-76
Max	125
Min	32
Mean	72.7

05/01/1977	51
05/02/1977	53
05/03/1977	59
05/04/1977	58
05/05/1977	57
05/06/1977	76
05/07/1977	69
05/08/1977	61
05/09/1977	59
05/10/1977	74
05/11/1977	98
05/12/1977	144
05/13/1977	109
05/14/1977	85
05/15/1977	79
05/16/1977	71
05/17/1977	70
05/18/1977	71
05/19/1977	72
05/20/1977	79
05/21/1977	69
05/22/1977	60
05/23/1977	139
05/24/1977	141
05/25/1977	148
05/26/1977	139
05/27/1977	135
05/28/1977	100
05/29/1977	87
05/30/1977	74
05/31/1977	62

May-77	
Max	148
Min	51
Mean	85

	May-77
Max	148
Min	51
Mean	85.5

09/01/1977	20
09/02/1977	18
09/03/1977	17
09/04/1977	12
09/05/1977	10
09/06/1977	16
09/07/1977	23
09/08/1977	15
09/09/1977	10
09/10/1977	13
09/11/1977	15
09/12/1977	13
09/13/1977	9
09/14/1977	10
09/15/1977	10
09/16/1977	18
09/17/1977	21
09/18/1977	22
09/19/1977	23
09/20/1977	29
09/21/1977	32
09/22/1977	30
09/23/1977	35
09/24/1977	39
09/25/1977	57
09/26/1977	60
09/27/1977	50
09/28/1977	60
09/29/1977	129
09/30/1977	111

Sep-77	
Max	129
Min	9
Mean	31

	Sep-77
Max	129
Min	9
Mean	30.9

05/01/1978	193
05/02/1978	170
05/03/1978	159
05/04/1978	156
05/05/1978	146
05/06/1978	122
05/07/1978	122
05/08/1978	129
05/09/1978	113
05/10/1978	110
05/11/1978	115
05/12/1978	106
05/13/1978	100
05/14/1978	93
05/15/1978	113
05/16/1978	118
05/17/1978	127
05/18/1978	127
05/19/1978	127
05/20/1978	127
05/21/1978	125
05/22/1978	125
05/23/1978	129
05/24/1978	128
05/25/1978	181
05/26/1978	203
05/27/1978	180
05/28/1978	137
05/29/1978	123
05/30/1978	111
05/31/1978	101
May-78	
Max	203
Min	93
Mean	133

09/01/1978	80
09/02/1978	94
09/03/1978	100
09/04/1978	105
09/05/1978	166
09/06/1978	342
09/07/1978	453
09/08/1978	303
09/09/1978	246
09/10/1978	243
09/11/1978	249
09/12/1978	219
09/13/1978	206
09/14/1978	202
09/15/1978	192
09/16/1978	181
09/17/1978	179
09/18/1978	176
09/19/1978	172
09/20/1978	170
09/21/1978	168
09/22/1978	163
09/23/1978	160
09/24/1978	159
09/25/1978	151
09/26/1978	138
09/27/1978	106
09/28/1978	115
09/29/1978	120
09/30/1978	111
Sep-78	
Max	453
Min	80
Mean	182

05/01/1979	225
05/02/1979	210
05/03/1979	156
05/04/1979	130
05/05/1979	151
05/06/1979	282
05/07/1979	282
05/08/1979	267
05/09/1979	252
05/10/1979	249
05/11/1979	225
05/12/1979	191
05/13/1979	157
05/14/1979	126
05/15/1979	117
05/16/1979	108
05/17/1979	95
05/18/1979	73
05/19/1979	62
05/20/1979	61
05/21/1979	60
05/22/1979	59
05/23/1979	63
05/24/1979	86
05/25/1979	80
05/26/1979	69
05/27/1979	67
05/28/1979	62
05/29/1979	64
05/30/1979	56
05/31/1979	54
May-79	
Max	282
Min	54
Mean	134

	May-78
Max	203
Min	93
Mean	132.8

	Sep-78
Max	453
Min	80
Mean	182.3

	May-79
Max	282
Min	54
Mean	133.5

09/01/1979	92
09/02/1979	87
09/03/1979	95
09/04/1979	95
09/05/1979	85
09/06/1979	66
09/07/1979	55
09/08/1979	57
09/09/1979	60
09/10/1979	51
09/11/1979	49
09/12/1979	52
09/13/1979	61
09/14/1979	62
09/15/1979	61
09/16/1979	63
09/17/1979	59
09/18/1979	56
09/19/1979	59
09/20/1979	66
09/21/1979	60
09/22/1979	61
09/23/1979	58
09/24/1979	53
09/25/1979	68
09/26/1979	75
09/27/1979	87
09/28/1979	90
09/29/1979	116
09/30/1979	119

Sep-79	
Max	119
Min	49
Mean	71

	Sep-79
Max	119
Min	49
Mean	70.6

05/01/1994	56
05/02/1994	53
05/03/1994	42
05/04/1994	51
05/05/1994	76
05/06/1994	154
05/07/1994	194
05/08/1994	175
05/09/1994	128
05/10/1994	92
05/11/1994	81
05/12/1994	69
05/13/1994	69
05/14/1994	55
05/15/1994	47
05/16/1994	56
05/17/1994	59
05/18/1994	54
05/19/1994	52
05/20/1994	74
05/21/1994	86
05/22/1994	99
05/23/1994	89
05/24/1994	88
05/25/1994	88
05/26/1994	52
05/27/1994	57
05/28/1994	58
05/29/1994	59
05/30/1994	56
05/31/1994	55

May-94	
Max	194
Min	42
Mean	78

	May-94
Max	194
Min	42
Mean	78.2

09/01/1994	16
09/02/1994	18
09/03/1994	20
09/04/1994	27
09/05/1994	26
09/06/1994	20
09/07/1994	14
09/08/1994	17
09/09/1994	19
09/10/1994	14
09/11/1994	13
09/12/1994	26
09/13/1994	26
09/14/1994	28
09/15/1994	31
09/16/1994	27
09/17/1994	30
09/18/1994	28
09/19/1994	29
09/20/1994	31
09/21/1994	31
09/22/1994	35
09/23/1994	32
09/24/1994	46
09/25/1994	43
09/26/1994	35
09/27/1994	45
09/28/1994	53
09/29/1994	66
09/30/1994	54

Sep-94	
Max	66
Min	13
Mean	30

	Sep-94
Max	66
Min	13
Mean	30.0

05/01/1995	355
05/02/1995	369
05/03/1995	369
05/04/1995	371
05/05/1995	373
05/06/1995	397
05/07/1995	445
05/08/1995	403
05/09/1995	339
05/10/1995	333
05/11/1995	279
05/12/1995	266
05/13/1995	265
05/14/1995	257
05/15/1995	241
05/16/1995	209
05/17/1995	184
05/18/1995	194
05/19/1995	203
05/20/1995	202
05/21/1995	206
05/22/1995	251
05/23/1995	230
05/24/1995	209
05/25/1995	213
05/26/1995	211
05/27/1995	180
05/28/1995	157
05/29/1995	137
05/30/1995	130
05/31/1995	115
May-95	
Max	445
Min	115
Mean	261

09/01/1995	61
09/02/1995	56
09/03/1995	55
09/04/1995	48
09/05/1995	47
09/06/1995	54
09/07/1995	56
09/08/1995	65
09/09/1995	64
09/10/1995	59
09/11/1995	58
09/12/1995	52
09/13/1995	56
09/14/1995	61
09/15/1995	69
09/16/1995	70
09/17/1995	67
09/18/1995	62
09/19/1995	52
09/20/1995	51
09/21/1995	56
09/22/1995	58
09/23/1995	62
09/24/1995	61
09/25/1995	80
09/26/1995	79
09/27/1995	78
09/28/1995	77
09/29/1995	85
09/30/1995	87
Sep-95	
Max	87
Min	47
Mean	63

05/01/1996	144
05/02/1996	148
05/03/1996	149
05/04/1996	153
05/05/1996	163
05/06/1996	157
05/07/1996	156
05/08/1996	149
05/09/1996	139
05/10/1996	140
05/11/1996	117
05/12/1996	101
05/13/1996	91
05/14/1996	94
05/15/1996	118
05/16/1996	121
05/17/1996	158
05/18/1996	269
05/19/1996	273
05/20/1996	215
05/21/1996	209
05/22/1996	275
05/23/1996	221
05/24/1996	211
05/25/1996	201
05/26/1996	161
05/27/1996	198
05/28/1996	200
05/29/1996	171
05/30/1996	151
05/31/1996	149
May-96	
Max	275
Min	91
Mean	168

	May-95
Max	445
Min	115
Mean	261.1

	Sep-95
Max	87
Min	47
Mean	62.9

	May-96
Max	275
Min	91
Mean	167.8

09/01/1996	43
09/02/1996	41
09/03/1996	46
09/04/1996	44
09/05/1996	50
09/06/1996	40
09/07/1996	44
09/08/1996	47
09/09/1996	41
09/10/1996	39
09/11/1996	42
09/12/1996	57
09/13/1996	63
09/14/1996	75
09/15/1996	92
09/16/1996	84
09/17/1996	82
09/18/1996	96
09/19/1996	103
09/20/1996	107
09/21/1996	108
09/22/1996	103
09/23/1996	115
09/24/1996	117
09/25/1996	116
09/26/1996	109
09/27/1996	107
09/28/1996	108
09/29/1996	107
09/30/1996	115

Sep-96	
Max	117
Min	39
Mean	78

	Sep-96
Max	117
Min	39
Mean	78.0

05/01/1997	164
05/02/1997	171
05/03/1997	162
05/04/1997	155
05/05/1997	156
05/06/1997	146
05/07/1997	145
05/08/1997	133
05/09/1997	112
05/10/1997	102
05/11/1997	111
05/12/1997	107
05/13/1997	114
05/14/1997	171
05/15/1997	146
05/16/1997	78
05/17/1997	72
05/18/1997	71
05/19/1997	67
05/20/1997	63
05/21/1997	58
05/22/1997	52
05/23/1997	64
05/24/1997	71
05/25/1997	80
05/26/1997	90
05/27/1997	86
05/28/1997	88
05/29/1997	74
05/30/1997	63
05/31/1997	70

May-97	
Max	171
Min	52
Mean	105

	May-97
Max	171
Min	52
Mean	104.6

09/01/1997	91
09/02/1997	92
09/03/1997	98
09/04/1997	86
09/05/1997	58
09/06/1997	58
09/07/1997	50
09/08/1997	42
09/09/1997	44
09/10/1997	43
09/11/1997	64
09/12/1997	64
09/13/1997	60
09/14/1997	75
09/15/1997	140
09/16/1997	134
09/17/1997	110
09/18/1997	123
09/19/1997	129
09/20/1997	118
09/21/1997	94
09/22/1997	72
09/23/1997	74
09/24/1997	82
09/25/1997	92
09/26/1997	103
09/27/1997	96
09/28/1997	93
09/29/1997	100
09/30/1997	106

Sep-97	
Max	140
Min	42
Mean	86

	Sep-97
Max	140
Min	42
Mean	86.4

05/01/1998	255
05/02/1998	293
05/03/1998	536
05/04/1998	683
05/05/1998	895
05/06/1998	824
05/07/1998	549
05/08/1998	470
05/09/1998	770
05/10/1998	1050
05/11/1998	891
05/12/1998	779
05/13/1998	614
05/14/1998	419
05/15/1998	371
05/16/1998	374
05/17/1998	493
05/18/1998	507
05/19/1998	432
05/20/1998	633
05/21/1998	1090
05/22/1998	917
05/23/1998	741
05/24/1998	664
05/25/1998	676
05/26/1998	723
05/27/1998	749
05/28/1998	758
05/29/1998	857
05/30/1998	1080
05/31/1998	911
May-98	
Max	1090
Min	255
Mean	678

09/01/1998	69
09/02/1998	68
09/03/1998	67
09/04/1998	67
09/05/1998	75
09/06/1998	73
09/07/1998	57
09/08/1998	62
09/09/1998	101
09/10/1998	95
09/11/1998	93
09/12/1998	97
09/13/1998	95
09/14/1998	99
09/15/1998	94
09/16/1998	93
09/17/1998	99
09/18/1998	94
09/19/1998	103
09/20/1998	105
09/21/1998	120
09/22/1998	111
09/23/1998	109
09/24/1998	121
09/25/1998	134
09/26/1998	134
09/27/1998	137
09/28/1998	152
09/29/1998	153
09/30/1998	143
Sep-98	
Max	153
Min	57
Mean	101

05/01/1999	247
05/02/1999	251
05/03/1999	270
05/04/1999	285
05/05/1999	235
05/06/1999	231
05/07/1999	231
05/08/1999	242
05/09/1999	236
05/10/1999	225
05/11/1999	208
05/12/1999	206
05/13/1999	203
05/14/1999	200
05/15/1999	205
05/16/1999	200
05/17/1999	195
05/18/1999	206
05/19/1999	195
05/20/1999	220
05/21/1999	227
05/22/1999	236
05/23/1999	237
05/24/1999	225
05/25/1999	214
05/26/1999	223
05/27/1999	232
05/28/1999	234
05/29/1999	236
05/30/1999	250
05/31/1999	236
May-99	
Max	285
Min	195
Mean	227

	May-98
Max	1090
Min	255
Mean	677.5

	Sep-98
Max	153
Min	57
Mean	100.7

	May-99
Max	285
Min	195
Mean	227.1

09/01/1999	71
09/02/1999	79
09/03/1999	67
09/04/1999	63
09/05/1999	62
09/06/1999	63
09/07/1999	65
09/08/1999	66
09/09/1999	68
09/10/1999	76
09/11/1999	96
09/12/1999	91
09/13/1999	79
09/14/1999	67
09/15/1999	72
09/16/1999	69
09/17/1999	76
09/18/1999	79
09/19/1999	79
09/20/1999	75
09/21/1999	72
09/22/1999	75
09/23/1999	77
09/24/1999	77
09/25/1999	89
09/26/1999	89
09/27/1999	97
09/28/1999	110
09/29/1999	113
09/30/1999	114

Sep-99	
Max	114
Min	62
Mean	79

05/01/2000	155
05/02/2000	165
05/03/2000	183
05/04/2000	175
05/05/2000	164
05/06/2000	157
05/07/2000	163
05/08/2000	173
05/09/2000	174
05/10/2000	154
05/11/2000	144
05/12/2000	151
05/13/2000	155
05/14/2000	155
05/15/2000	155
05/16/2000	184
05/17/2000	175
05/18/2000	170
05/19/2000	162
05/20/2000	130
05/21/2000	128
05/22/2000	130
05/23/2000	132
05/24/2000	138
05/25/2000	131
05/26/2000	134
05/27/2000	116
05/28/2000	113
05/29/2000	113
05/30/2000	125
05/31/2000	126

May-00	
Max	184
Min	113
Mean	149

09/01/2000	36
09/02/2000	40
09/03/2000	48
09/04/2000	47
09/05/2000	58
09/06/2000	64
09/07/2000	60
09/08/2000	48
09/09/2000	34
09/10/2000	34
09/11/2000	47
09/12/2000	50
09/13/2000	48
09/14/2000	42
09/15/2000	42
09/16/2000	58
09/17/2000	53
09/18/2000	64
09/19/2000	76
09/20/2000	77
09/21/2000	102
09/22/2000	90
09/23/2000	89
09/24/2000	85
09/25/2000	92
09/26/2000	88
09/27/2000	89
09/28/2000	89
09/29/2000	96
09/30/2000	95

Sep-00	
Max	102
Min	34
Mean	65

	Sep-99
Max	114
Min	62
Mean	79.2

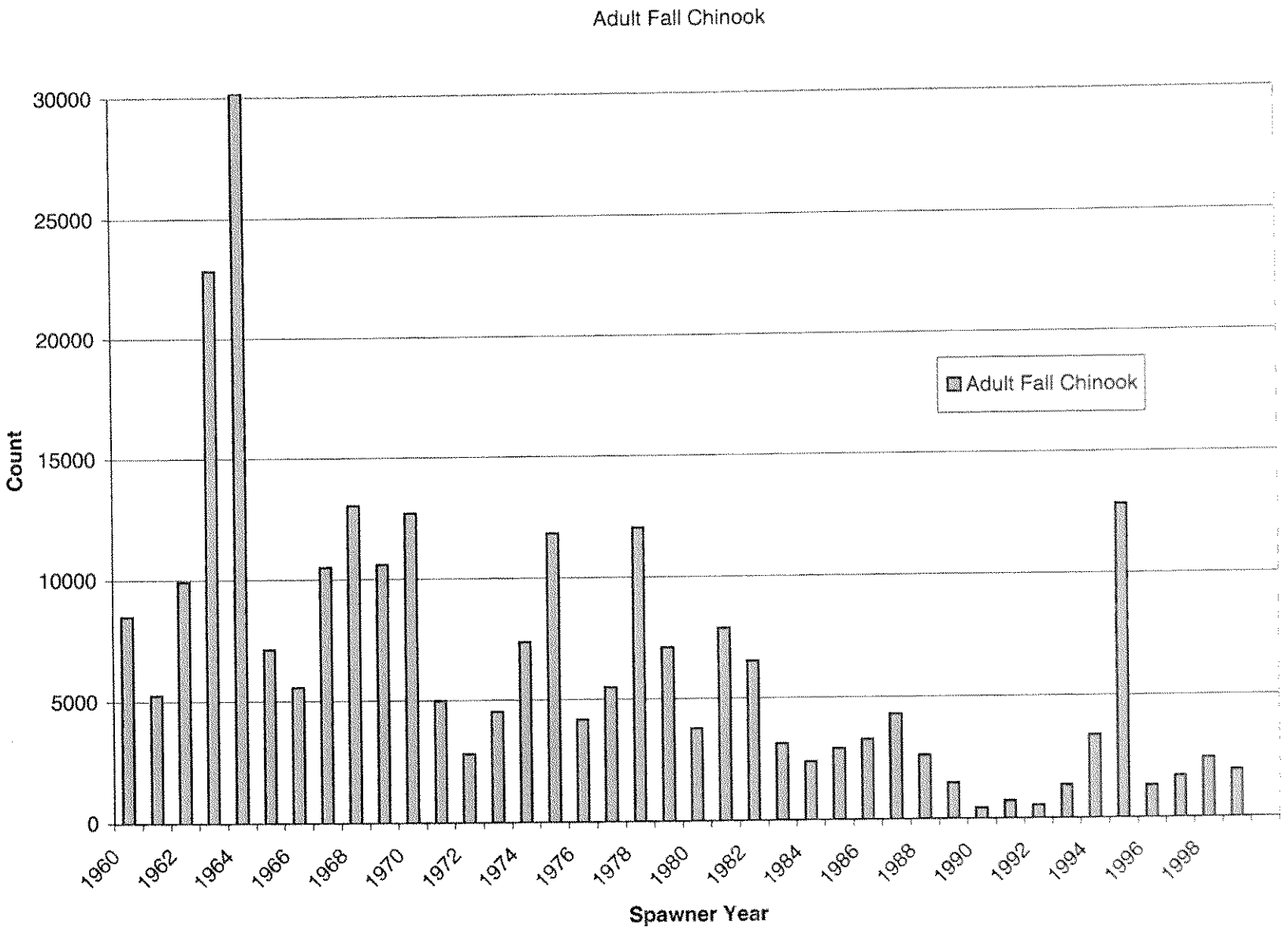
	May-00
Max	184
Min	113
Mean	149.4

	Sep-00
Max	102
Min	34
Mean	64.7

Fall Chinook Salmon Returns to Shasta River
1960-1999

Attachment 6

Year	Adults	-Year old	Total
1960	8495	995	9490
1961	5250	3514	8764
1962	9907	4991	14898
1963	22824	9013	31837
1964	30175	3648	34363
1965	7136	775	7911
1966	5573	451	6024
1967	10478	1836	12314
1968	13039	1003	14042
1969	10576	3049	13625
1970	12693	712	13405
1971	4970	1646	6619
1972	2802	839	3614
1973	4516	4902	9418
1974	7376	2729	10105
1975	11821	4211	16032
1976	4154	1919	6073
1977	5478	1969	7447
1978	12024	6707	18371
1979	7111	1040	8151
1980	3762	4334	8096
1981	7890	4330	12220
1982	6533	1922	8455
1983	3119	753	3872
1984	2362	480	2842
1985	2897	2227	5124
1986	3274	683	3957
1987	4299	398	4697
1988	2586	256	2842
1989	1440	137	1577
1990	415	118	533
1991	716	10	726
1992	520	66	586
1993	1341	85	1426
1994	3363	1840	5203
1995	12816	695	13511
1996	1305	145	1450
1997	1677	334	2011
1998	2404	138	2542
1999	1895	1292	3187


Adult Fall Chinook
30000
25000
20000
15000
10000
5000
0
Count
Adult Fall Chinook
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
Spawner Year